AUG 28 '53

July-August 1953

METAL TREATING

MASTER CRAFTSMEN
METAL TREATING INSTITUTE

These two furnaces of unique design are installed at the George H. Porter Steel Treating Company, Cleveland, Ohio. Side charging with two and three separately operated doors permits the economical use of these furnaces for small parts although primarily designed for very long pieces.

THE *Only* MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

The Brazing is Practically Free!

...when you combine it with salt bath carburizing or hardening

Any material that can be brazed at all can be brazed in an Ajax Electric Salt Bath Furnace—much faster, better and usually at lower cost. But that's only part of the story!

Where a steel assembly for brazing also requires carburizing or hardening, the entire job can be done in a single heating operation so that brazing is practically free. Note examples on this page.

The "secret" lies in brazing with brass during the carburizing operation. This money-saving method is possible only with a salt bath furnace, thanks to its greater heating speed—so fast that no dezincification of the brazing metal occurs. Moreover, the steel assembly is brazed and carburized below 1700° F. instead of at 2050° F. as required for copper brazing. Thus, distortion and grain growth are greatly reduced and furnace operating costs are less. Conclusive tests prove that brass-brazed joints are fully as strong as those of copper.

For straight brazing employing copper, silver or aluminum, the Ajax furnace offers from 4- to 6-times faster heating cycles. Amazingly accurate temperature control minimizes distortion. Selective heating is easy. Scaling or decarburization are avoided and floor space requirements are only a fraction of those required with any other production brazing system.

Write *for Ajax Bulletin #72 and Reprint #124*

Bring *production batches of your materials to the Ajax Metallurgical Service labs for on-the-job demonstrations of Ajax efficiency.*

AJAX ELECTRIC COMPANY, INC.
940 Frankford Avenue Philadelphia 23, Pa.

Associated companies: Ajax Electric Furnace Corp.; Ajax Electrothermic Corp.; Ajax Engineering Corp.

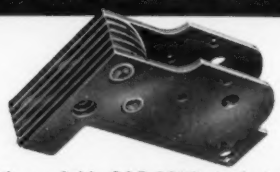
A 51% Saving!

Ajax combined carburizing and brass-brazing reduced rejects 50%, effected savings of 51% and improved the quality of this wrench jaw. Steel jaw insert is brazed in place and the entire assembly carburized in one heating at 1675° F. Brazed joints must pass a test of 40,000 psi.

ONE HEATING DOES 2 Jobs!

Carburizing and brazing of this motor starter assembly are done simultaneously in a single Ajax salt bath with one heating of the work. A water quench completes the job. A conventional carburizing bath produces a case depth of .015" in 50 minutes.

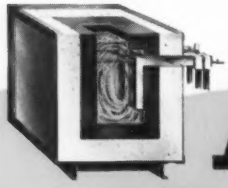
QUALITY IMPROVED—Costs Cut!



The laminations of this SAE-1010 steel stapler bracket are securely brass-brazed at the same time the surface is being carburized. Wearing surfaces are file hard. Distortion is less than .005". The entire carburizing-brazing operation was done in 20 minutes.

WARP-FREE HARDENING Plus BRAZING

Warpage on this magnetic lock part is negligible thanks to complete protection during hardening in a neutral salt bath. The flange is securely brass-brazed to the steel cup in the same operation. Brazing metal is confined neatly to the joint—does not spread over the parts.



AJAX electric SALT BATH furnaces

World's largest manufacturer of heat-treating furnaces exclusively

Editorial...

THE NEW "BUSINESS SERVICES ADMINISTRATION"

With the expiration of the National Production Authority a new agency known as the "Business Services Administration" will be formed to function as a part of the Department of Commerce with the objective of continuing on a more efficient and effective basis many of the useful services to business for which the Department was originally created. It was good news to note that this new agency is not to be an addition to our currently inflated national overhead but will be condensed from the former NPA body and personnel.

As stated, the objective of this Administration will be as follows:

1. Continue Production Directives.
2. Supply helpful information to industry.
3. Establish, with industry, a mobilization base and post-attack program.
4. Maintain an operating nucleus for full scale operation in the event of war or grave emergency.
5. Act as the voice of industry in government.
6. Give industry some weight in approving or disapproving policy and plans from the standpoint of practical industrial workability.

Starting with the correct premise that business, small and large, has been the whipping boy of government for over 20 years, Secretary of Commerce Weeks acknowledged that much damage has been done through both deliberate attack and ignorant action. A basic change in attitude to friendly support and cooperation plus the elimination of ignorance by giving industry a "voice . . . in government," and . . . "some weight in approving or disapproving policy and plans," should mean a great deal to the heat treating and metal working industries.

Note: Just as this issue went to press, Congress adjourned after having voted the annual appropriation for the Department of Commerce. The money allocated for the new BSA was considerably less than the original amount requested so that the program outlined may have to be curtailed. However, if all industries will offer their active cooperation, constructive achievements will be made.

More About "Unsatisfactory Heat Treating Results"

In our last issue we requested the cooperation of heat treaters and metallurgists in an important undertaking—that of compiling and classifying the causes and prevention of unfavorable heat treating results. We again make this request and hope that we may look forward to receiving data, photographs, sketches, etc., which will aid in this work. We would also like to have your comments on this project with any suggestions which may add to its effectiveness.

METAL TREATING

Official Journal of the Metal Treating Institute

National Trade Association of Commercial Heat Treaters

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HORACE C. KNERR, *Chmn., Pub. Comm.*, Metlab Co., Phila., Pa.
C. E. HERINGTON, *Editor*
B. A. FLANAGAN, *Advtg. & Prod. Mgr.*, JOHN J. CODELLA, *Business Mgr.*
271 North Ave., New Rochelle, N. Y.

SALES REPRESENTATIVES
R. F. PICKRELL, 314 Stephenson Bldg., Detroit 2, Mich.—TR 1-0790
W. F. GREEN, 439 S. Western Ave., Los Angeles 5, Calif.—DU 7-8135
DICK WESTON, 6 East 39th St., New York, N. Y.—MU 5-9450

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271 North Avenue
New Rochelle, New York

Automatic Heat Treatment of Crankshafts in Hagan Automatic Units

EDITOR'S NOTE: This article and the one following are the first in a symposium on continuous flow heat treating furnaces. Future articles will cover shaker, rotary, roller and conveyor hearth types.

By C. H. SCHWERIN
Manager of Sales
George J. Hagan Company
Pittsburgh, Pa.

Automotive crankshafts are heat treated automatically at the rate of 300 per hour in three continuous George J. Hagan Company Heat Treat Units. Each unit is 152 ft. long overall, divided as follows: charger 6 ft., hardening furnace 51½ ft., quench mechanism 7 ft., draw furnace 82 ft. and unloader 5½ ft. An average of 10,000 pounds net of crankshafts is heated per hour in each unit.

Crankshafts, averaging 100 lbs. each, are brought to the hardening furnace in tote boxes, from which they are lifted by an air hoist and loaded on alloy carrier grids. The grids are brought from the discharge end of the draw furnace to the charging end of the hardening furnace by an overhead conveyor. All average crankshafts, including the new V-8 crankshafts, are handled on these grids without any added jigs or alterations. The grids weigh 14 lbs. each.

The crankshafts are moved transversely through the furnaces in two parallel rows, each row of crankshafts riding on two rows of heat resisting alloy roller rails. Two crankshafts are loaded on each pair of carrier grids. The unit charge consists of four crankshafts and four grids. Every 2.4 minutes a fresh charge is pushed into the hardening furnace by a twin screw charger and at the same time a like charge of heat treated crankshafts is removed from the draw furnace.

The hardening furnace shown in Fig. 1 holds 37 charges or a total of 148 crankshafts, with four more on the charger ready to be charged. The heating time in the hardening furnace is 1 hour and 29 minutes.

The hardening furnace has four zones of burner control with individual thermocouples connected to potentiometer temperature controller-recorders. Each zone is fired by a bank of gas burners on each side of the furnace; the banks in the first two zones have both overfired and underfired burners, while the last two zones contain underfired burners only. The lower burners fire into combustion chambers located below hearth level, while the upper burners fire over the stock to prevent flame impingement on the crankshafts.

The chamber temperature in the various zones is as follows: Zone 1—1440°F.; Zone 2—1525°F.; Zone 3—1560°F.; Zone 4—1575°F.

Combustion air at 16 oz. is supplied by a blower. Each zone has a motor-operated valve regulating the air flow; the gas flow is controlled by the air flow through zero gas regulators and separate burner aspirators.

A safety shut-off valve is provided which shuts off the main gas supply in case of fuel, air or electric failure. The controls of this valve are so arranged that it must be manually re-opened to restore the gas supply after the abnormal conditions have been corrected.

Automatic Quenching

As each fresh load of crankshafts is pushed into the hardening furnace, a hot charge is removed from the discharge end by the quench transfer mechanism. Motor-operated doors at each end of the hardening furnace open and close automatically in proper sequence with the charging and discharging movements. As seen in Fig. 2, the four hot crankshafts just withdrawn from the hardening furnace are removed from the carrier grids and immersed in a water quench bath which is automatically maintained at a temperature ranging between 110°F. and 120°F. by the controlled addition of fresh water. The crankshafts remain in the quench for times varying from 64 to 90

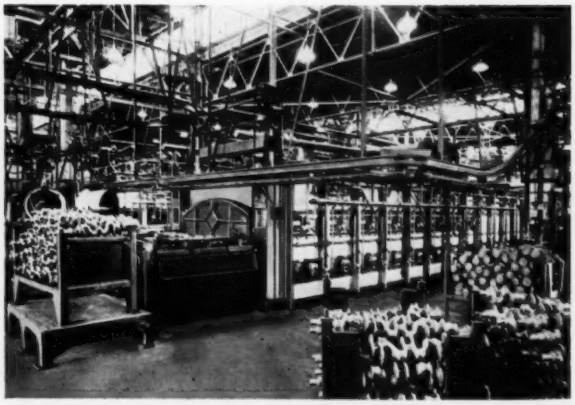


Fig. 1—Charger and hardening furnace of one unit with capacity of 10,000 pounds per hour. Crankshafts are supported on alloy carrier grids which are returned to the charger by overhead conveyor.

seconds, depending on the size of the crankshaft, and are then replaced on the carrier grids. The length of time in the quench bath is adjustable over a wide range, independently of the time interval between charges.

Immediately following the delivery of the four hot crankshafts to the quench bath as previously described, the quench transfer mechanism charges a set of four crankshafts and their mating grids into the draw furnace. Simultaneously with this movement, the unloader removes a set of four drawn crankshafts and their mating grids from the discharge end of the draw furnace. Motor-operated doors at each end of the draw furnace open and close automatically in proper sequence with the charging and discharging movements.

The quenching unit occupies a space of 7 ft. between the hardening and draw furnaces and the quench transfer mechanism has space for four unit charges or 16 crankshafts. The first space is for the hot charge from the hardening furnace, the second and third spaces are for quenched shafts which are draining, and the fourth space is for the unit charge ready to be pushed into the draw furnace.

The time from the hardening furnace to the quench is 20 seconds. The time from the quench to the draw furnace is 8 minutes.

Draw Furnace

The draw furnace is of similar construction to the hardening furnace, with four rows of grids and roller rails supporting two rows of crankshafts. This furnace is heated by three external Hagan heavy duty recirculating air heaters mounted on top of the furnace. See Fig. 3.

Each heater is equipped with three burners and two 1600°F. recirculating fans. The gases are drawn out of the work chamber into the heater. The fans then force the heated gases back into the work chamber through the masonry ducts in the side walls leading to discharge ports under the hearth.

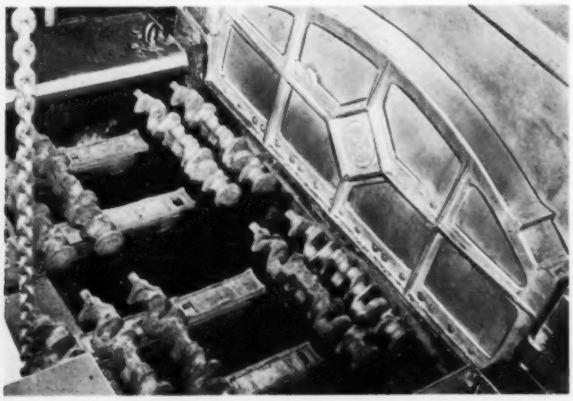


Fig. 2—Quenching mechanism showing four shafts (one unit charge) removed from carrier grids for quenching. Charging and discharging of hardening and draw furnaces as well as quenching are automatically synchronized.

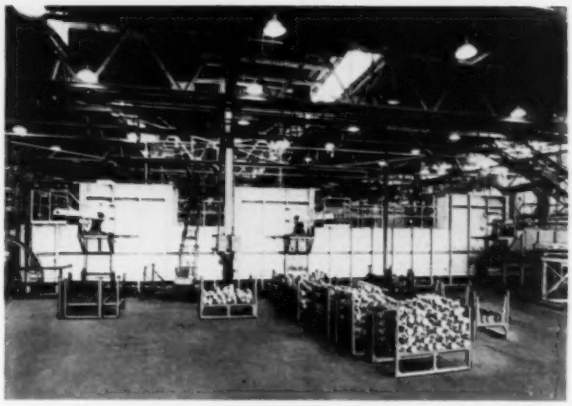


Fig. 3—Side view of 82' long draw furnace showing three heavy duty recirculating air heaters mounted on top.

The 82 ft. long draw furnace holds 59 unit charges or 236 crankshafts, giving a heating time in the furnace of 2 hours and 22 minutes. The furnace has three zones of control corresponding to the three air heaters.

Each air heater is provided with a thermocouple connected to a potentiometer temperature indicator-controller which has a maximum temperature setting in order to prevent overheating and damage to the recirculating fans. The heater temperatures and the maximum set temperatures are as follows:

Zone 1—1175°F. (1400°F. maximum setting); Zone 2—1170°F. (1400°F. maximum setting); Zone 3—1100°F. (1250°F. maximum setting).

Control of the crankshaft temperatures is obtained through thermocouples in each zone of the work chamber, connected to potentiometer temperature recorder-controllers.

A combustion blower delivers 16 oz. combustion air to all three heaters. The fuel input for each heater is regulated by a motor operated air valve through cross-connected gas governors and separate burner aspirators.

Each burner on the draw furnace has a safety device which shuts off the fuel supply to the immediate heater in case of pilot flame failure. The gas and air lines are provided with pressure switches which actuate a safety valve to shut off the fuel in event of failure of gas, combustion air or power. Each recirculating fan is provided with an air flow switch which shuts off the fuel supply in the event that either recirculating fan stops.

The safety equipment is inter-connected with a timer which requires a five-minute purge period before burners can be lighted either in initial starting up or when starting the furnace after shut-down. ■■■

By HORACE C. KNERR, *President*
Metlab Company
Philadelphia 18, Pa.

Large Rotary Hearth Furnace

During World War II there was an accelerated demand for heat treated forgings of various types, such as shell, aircraft and diesel engine cylinders, torpedo heads, etc. Metlab Company received an order for the heat treatment of a large tonnage of such parts which stipulated that production be started within two months. It was necessary to install a furnace to handle the job. Commercial furnace deliveries were quoted at six months to a year. Materials were under war-time restrictions and it was almost impossible to obtain heat resisting alloy and many other items normally required in the construction of continuous furnaces of large capacity.

To meet this situation it was therefore necessary for our company to design a furnace which could be constructed quickly out of ordinary materials immediately available in stock. That meant ordinary structural steel, refractories, inspirator gas burners and the simplest form of mechanism. As heat resisting alloys were unavailable because of the nickel shortage, no metallic material should be exposed to furnace temperatures. It was, of course, imperative that accurate and uniform temperature control be maintained.

Under this set of circumstances Metlab Company decided upon a rotary furnace with an under-fired hearth, the latter resting upon a doughnut shaped metal car of common steel, supported on stock crane wheels which rolled upon a circular track.

Design work was carried on while construction progressed. Beginning with space on a concrete floor approximately 35' square, tracks were laid, vertical buck stays installed and a circular hearth built in place consisting of pre-cast refractory sections lying on a plate steel base. Side walls were of insulating brick and the arch of cast insulating refractory.

There were 64 ducts in the hearth, each corresponding with one of 64 burners mounted on the outer wall. General details are shown in the sketch, Fig. 1 and the photograph Fig. 2.

Doors were raised and lowered by means of electric Budgit hoists. Two doors were provided but operations proved one was sufficient for both loading and unloading. Rotation was step-by-step, each step being equal to the space between the burners, using a re-

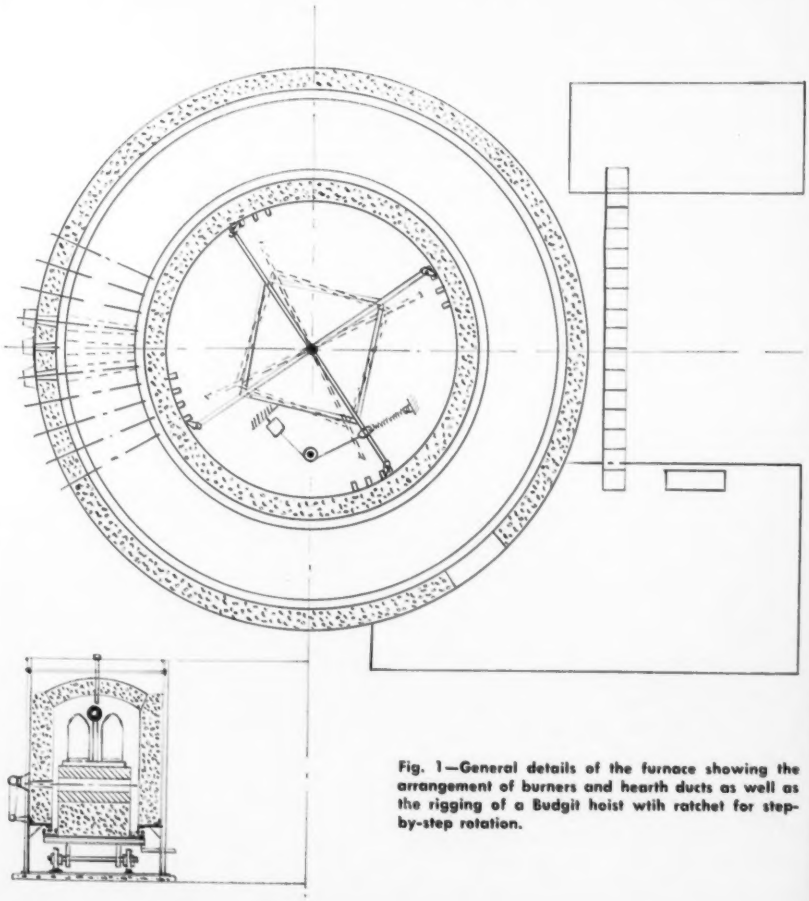


Fig. 1—General details of the furnace showing the arrangement of burners and hearth ducts as well as the rigging of a Budgit hoist wtih ratchet for step-by-step rotation.

Fig. 2—General view of the furnace showing the use of a manipulator for loading and unloading.

ciprocating star-type ratchet turning device, operated by a Budgit hoist rigged for electrical control. Push button control and an automatic timer provided for intermittent or continuous movement of the hearth, one step at a time.

Work was loaded and unloaded by means of a manipulator employing electricity and compressed air to pick up parts weighing from 25 to 500 pounds. Parts were placed on a roller conveyor for quenching.

The hearth diameter was 27', giving a circumferential travel of 60'. Heating space was 3' wide and 3' high. Twelve thermocouples extended through the arch, connected with a multiple point recording pyrometer—burners were hand regulated. The under-fired feature assured temperature uniformity around the work. Propane gas was used for fuel at 30 pounds pressure for maximum efficiency of the burners. This gave a very flexible firing arrangement. It was possible to heat the entire furnace to a uniform temperature throughout or create temperature differentials for pre-heat, soaking or even a furnace cool before discharge.

The capacity of this furnace is between 1000 and 4000 pounds per hour depending upon size of the work and heating requirements. The furnace has been successfully used with a large variety of work, some of which is shown in Figs. 3 and 4. Present use is dependent upon enough work for a continuous run of at least several days. ▪▪▪

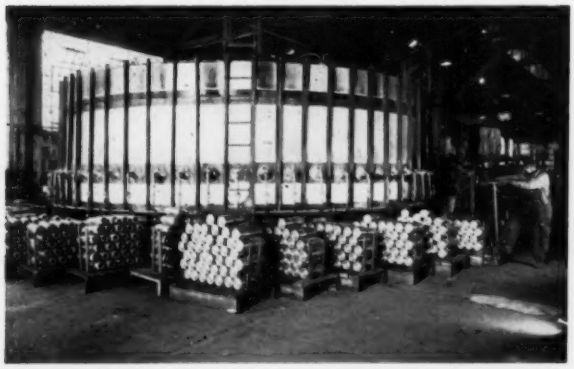


Fig. 3—View of furnace opposite charging door. Shell in foreground constituted much of original output along with tank parts, torpedo heads, etc.

Fig. 4—Typical tank part forgings which were heat treated in large quantities.

LARGE IN-LINE FACILITIES of HUGHES TOOL COMPANY

Nearly four decades ago, Howard Hughes, Sr., perfected the rolling cutter type bit for rotary rock drilling. This was the first bit with which rock could be successfully drilled using rotary tools. Before this time the development of deep wells in petroleum fields was hindered by the inability of "fish-tail" bits to penetrate hard rock.

In drilling, the bit is attached to the bottom drill collar at the end of the drill stem and the entire assembly rotated from ground level. The weight of the drill collars, or tubes, forces the cutter teeth into the formation being drilled and chips away at the bottom of the well. The cuttings are brought to the surface by the upward current of flushing fluid which

Fig. 2—Hughes Rotary Drills are laboratory tested on an actual drilling rig and in similar materials to those encountered in well drilling.

is pumped down from ground level to the bit through the drill collars. Rotation of the drill causes the multiple cone-shaped cutters to rotate, thereby bringing all teeth into cutting position, one after the other.

The manufacture of bits and drilling equipment is the result of long years of engineering and metallurgical study, and has reached a high stage of perfection. The Hughes Tool Company produces about 2,500 assembled bits daily, each said to require about 1100 individual operations, including the manufacture of built-in ball and roller bearings. While

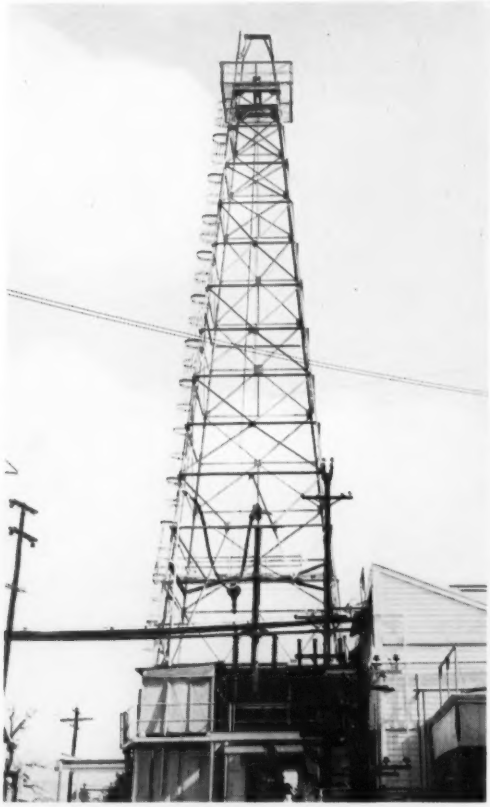


Fig. 1—Outside of the laboratory the drilling rig handles the test drilling equipment.

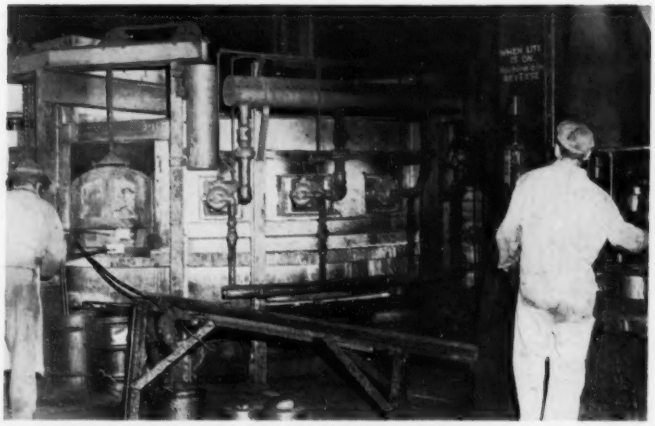


Fig. 3—Part of the forge shop at the Hughes Tool Company, Houston, Texas. Here is one of the gas-fired rotary hearth billet heating furnaces.

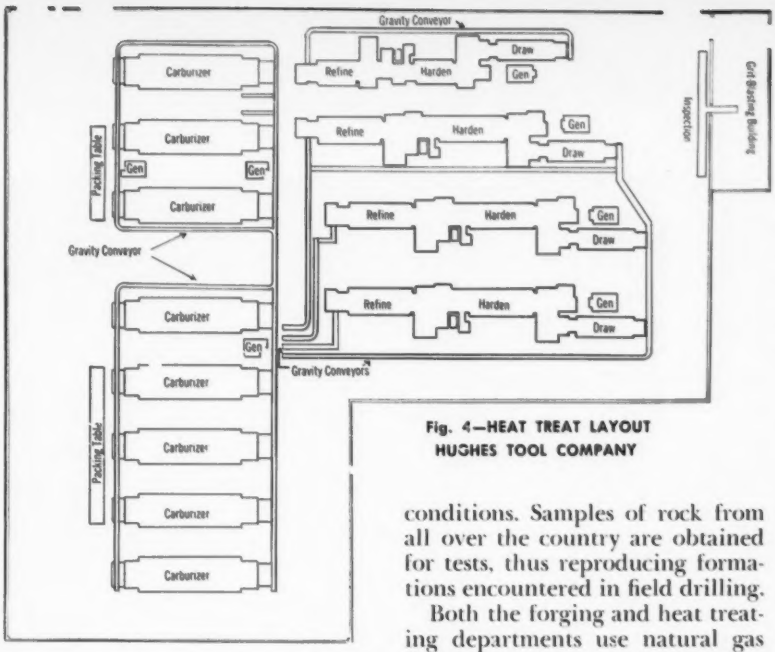


Fig. 4—HEAT TREAT LAYOUT HUGHES TOOL COMPANY

the basic principle of present day bits is the same as that of the original 1909 bit, they are radically different in design and manufacture. Hughes has developed a great variety of rotary bits for diverse requirements. They maintain a large research and engineering laboratory where comprehensive tests are carried out seven days a week for product improvement.

An indication of the time and effort put into research can be gained from Figs. 1 and 2. Here are shown a fully working drilling rig to handle test drilling equipment and a laboratory drilling rig used to test rock bits under field conditions. Samples of rock from all over the country are obtained for tests, thus reproducing formations encountered in field drilling.

Both the forging and heat treating departments use natural gas fuel. In the heat treating industry natural gas, where economically available, is probably the fuel preferred above all other sources of heat because of high heat content, cleanliness and adaptability for accurate temperature control. Contrary to expectations some years ago, the supply of natural gas has increased rather than become depleted. In 1935 production was somewhat below 4 trillion cubic feet and proven recoverable reserves about 64 trillion. Today, annual production has increased to nearly 9 trillion cubic feet, while the recoverable reserves have increased to almost 200 trillion cubic feet. This is truly a credit to the aggressive development of petroleum resources made possible by new equipment and methods typified by years of research and product development at Hughes Tool Company.

The company carries out almost all production operations within their own plant. Parts are forged from high quality alloy steels, billets being heated in three rotary hearth direct gas-fired furnaces, as shown in Fig. 3 and four gas-fired pusher type furnaces. The rotary hearth furnaces have capacities of 3,000-6,000 and 8,000 pounds per hour while the pusher types have a total capacity of 15,500 pounds per hour.

The general layout of the heat treating department is shown in Fig. 4. There are eight gas-fired, radiant tube, controlled atmosphere carburizing furnaces. Each unit is 60 feet long with a 35 foot effective heating area having ten burners on each side using gas up to 21" pressure at the rate of 100 to 150 cu. ft. per hour. The units are pusher type, moving the work at intervals of 35 to 75 minutes. Heating cycle is 1700°F. for 17 to 35 hours depending on case depth required.

Hardening is done in four, three-stage continuous furnaces as shown in Fig. 5. Each consists of three gas-fired, radiant tube, controlled atmosphere furnaces for refining, hardening and tempering. Another piece of heat treating equipment at the plant is the direct gas-fired car bottom furnace used for hardening drill collars shown in Fig. 6. ■■■

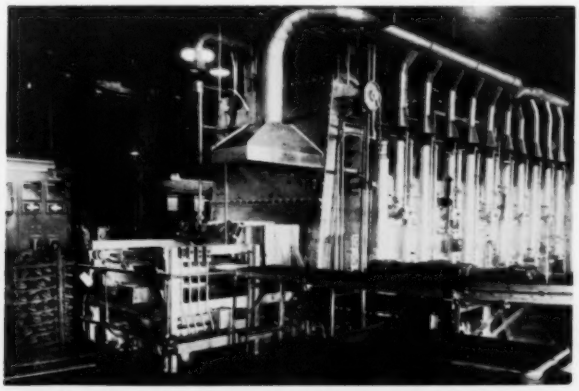


Fig. 5—Another section of the Hughes Tool Company heat treating department has twelve ultra-modern gas-fired, radiant tube, prepared atmosphere furnaces. They are arranged in units of three furnaces in four lines, and each has a refining zone, quench, hardening zone, and another quench, then a draw zone.

Fig. 6—Drill collars, on account of their length, are heat treated in a special direct gas-fired car furnace. On completion of the heating cycle, the car is withdrawn from the furnace alongside of an oil quenching pit into which they are placed by the overhead crane.

THE IMPORTANCE OF HEAT TREATMENT IN THE MANUFACTURE OF OIL WELL SUCKER RODS

By G. H. Dickinson
Plant Engineer
W. C. Norris, Manufacturer, Inc.

EDITOR'S NOTE: Sucker rods are long, slender shafts, 5/8" to 1" in diameter, 25' to 30' long. They are used to operate oil well pumps and at times extend more than a mile in connected "strings" between the pump plunger at the bottom of the well and ground level.

This is the story of one of the Oil Industry's most important tools—the Sucker Rod; and of the study, care and research constantly being expended to give it the armor and stamina it must have to perform the severe task assigned to it. Everyone familiar with petroleum and its production knows the sucker rod as the "middle-man" between the little pump deep in the earth and the collecting system at the surface, but only a few are in position to realize just how much thought and precision goes into its manufacture, from the original compounding of the raw steel, to the trim, straight tool the sucker rod has to be when laid down at the well site.

From the time a new rod is first placed in operation there are various factors that work unceasingly to "break it down"; one of the most common and most vicious of which is corrosion. "Corrosion Fatigue," the Production Superintendents' nightmare, is costing the Oil Industry millions of dollars yearly, but its inroads are gradually being restricted through the efforts of countless Chemists, Engineers, Metallurgists, Heat Treaters and others whose task it is to study its methods in order to reduce its staggering yearly toll in every possible way.

The relationship between heat treatment and corrosion resistance is readily understood when we realize that vital physical and chemical transformations can and do occur with the heating and cooling of metals; and, further that we can predetermine, and obtain to a remarkable degree, desired end-results in steel characteristics by carefully controlled cycles of heating and cooling. Because a sucker rod must have very special physical and chemical properties, the selection of the steel from which it is to be made involves careful analysis, not only of conditions under which it might be expected to operate, but also of the geographical area where it will work. Well fluids found in the various oil producing localities differ widely in both physical and chemical properties, each presenting individual demands which no all-purpose rod could possibly satisfy. The final outcome then is the need for a variety of types of sucker rods, each fortified to meet some specified extreme conditions. Besides having the general requisites of strength and elasticity, there is one other prime quality that every rod, regardless of size or type, must possess. That quality is "Uniformity"; uniformity of basic components, of grain structure, contour of surface, and even of connections. The more nearly uniform the sucker rod, the less will be its susceptibility to breakdown under severe working conditions.

The attainment of these qualities is not an accident, but comes from the use of up-to-the-minute equipment, coupled with precise control throughout every phase of manufacture; extending even to the handling of the product during shipment. A slight kink, or even minute surface imperfections due to rough handling could result in costly failure during operation.

Although residual stresses, resulting from manufacturing and fabricating processes, are not always conducive to corrosive attack they are very often a cause of low resistance to operating stresses such as occur in a sucker rod string where the load changes in magnitude and direction at high or low frequency. Intensive study of thousands of pumping wells in the field has shown that unequally stressed areas in a sucker rod are consistently more vulnerable to corrosive activity and, in conjunction with cyclic stress, seem to tend to reduce the endurance limit of the steel. This combination of stress and corrosion can bring about the type of failure which we call "Corrosion Fatigue." Localized stress areas can also influence corrosion to the extent that a form of inter-crystalline corrosion can occur in metals that are work-stressed in corrosive environment.

The first major step in the creation of a sucker rod is of course the forming of the end connections, a forging process wherein the ends are heated to a temperature of approximately 2250 degrees, then subjected to several passes in the forging dies, to produce the contour desired for threading operations. Since this article is concerned primarily with heat treating, however, we will mention only in passing that the forging process, like all others, is performed under rigid control at all times in the interest of uniformly high quality.

Shown here are the successive steps in the forging of sucker rods. Ends are threaded and joined with couplings.

The amount and type of heat treatment indicated for a specific rod is determined by the kind of steel of which it is to be made and the anticipated service conditions to be met. Some types of rods require more heat treatment than others in order to insure more critical modification of grain structure or to give greater resistance to detrimental forces. In some instances also, rods are run through an oil quench, followed by a draw at a temperature just under the transformation point, with a final "stretch" in the cooling process, to gain the utmost in straightness.

Because straightness is of major importance every manufacturer includes at least one straightening operation in its production process. Some run all raw stock through a straightening device as the first step in the "line," while others prefer to concentrate upon other characteristics in the beginning and finish up with a "draw and stretch" as just described.

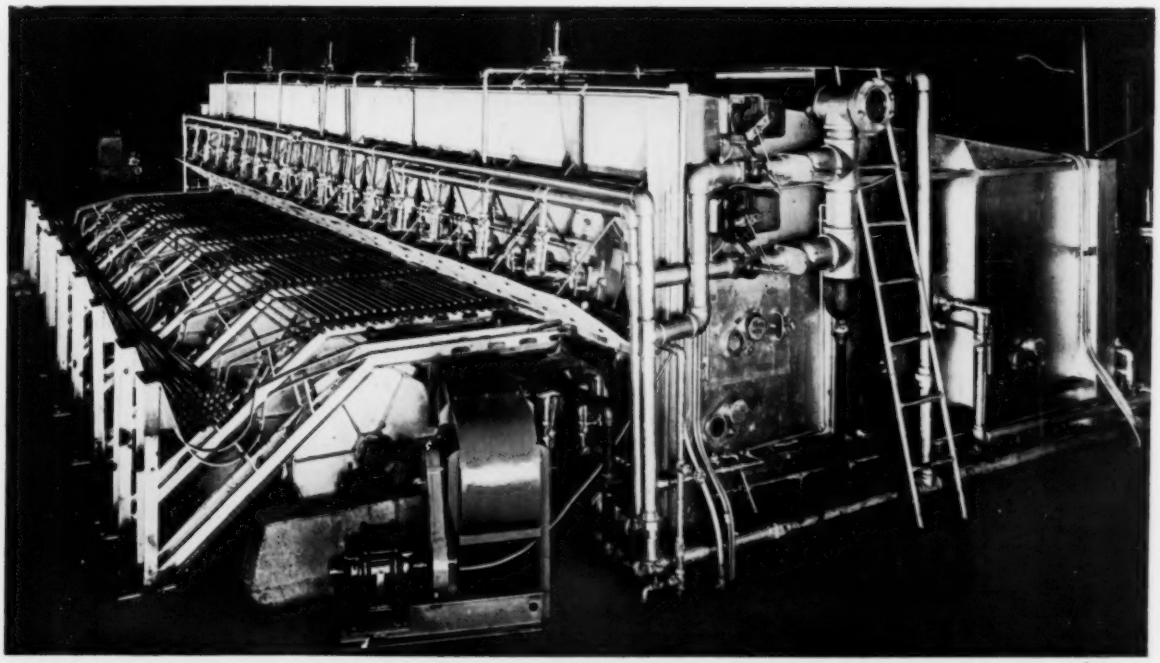
In the average heat treating operation bundles of raw rod stock are fed to the furnace loading rack by crane. The rods are then rolled out upon the charging table rails and into the lugs of the conveyor chains which propel them through the charging slot, into the preheat zone of the furnace. Each rod is constantly rotated to maintain straightness and to avoid any possibility of even slight deformation. Timing, travel, temperature, are all controlled by electronic instrumentation, accurate beyond the scope of human error, and designed to watch over and produce sucker rods as nearly identical as humanly possible. We might add here also that this same care and precision is carried on into the manufacture of sucker rod couplings.

As indicated previously the time required for proper heat treatment is pre-determined by the size of the rods and type of steel, but in all cases uniform distribution and penetration of heat is imperative.

Emerging from the furnace the rods move out upon a cooling rack, still rotating to expose all surface area possible to the cooling air. The use of forced air cooling units is common practice in some production lines. Here again, as in the case of the heating of the work, precise control plays a very important role. The quenching rate and its degree of uniformity is a vital part of any heat treating process, especially so in the case of sucker rods where an even grain structure throughout the entire length of the rod is essential to eliminate areas of concentrated stress. When cooled sufficiently they are deposited in a bundling rack and picked up by the crane once more, to be stored for further processing.

The conventional furnace designed for heat treating sucker rods must of necessity have a very sturdily constructed structural steel framework and shell to support the refractory lining, heavy duty conveying equipment, and withstand the endless work loads imposed upon it. It also has to be a versatile unit in a great many respects, both as to capacity and performance. It must be long enough to take thirty foot rods, yet the conveyor system in some instances has to be spaced to provide for processing "pony rods" which are short sucker rods made in multiples of two feet, in lengths from four to twelve feet inclusive. As an additional complication the burner and conveying equipment must be adaptable to synchronized operation through a multitude of heat-and-time combinations, as required by rods of different sizes and types. Some conveyors are designed with spirally fluted rotating shafts, instead of chains, to transport the rods. The conveyor speed is regulated through variable-speed gear reduction units, permitting wide

(Continued on page 34)



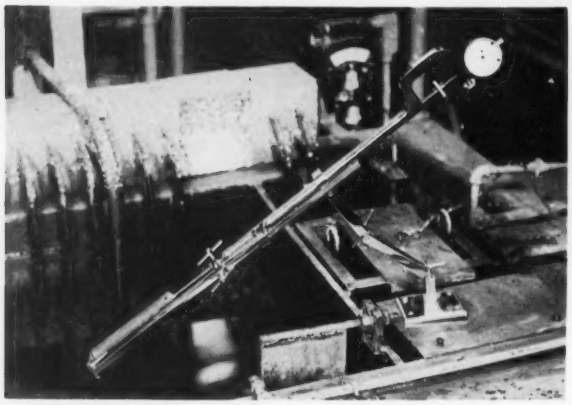
This furnace was built by the W. C. Norris Company for normalizing sucker rods up to 30' long. Rods are carried through the furnace between the lugs of alloy conveyor chain at the rate of 4½" per minute and are discharged on the cooling rack at left.

News to Heat Treaters...

New Dilatometer

The Ajax Electric Company, Philadelphia 23, Pa., recently announced that it has investigated the merits of the Schaaber Dilatometer, a new apparatus developed in Germany. Its principle is based on the volume change which takes place during the transformation of austenite.

The difficulty of measuring complete transformation is at times an evasive problem confronting



production control. The common method used to determine the extent of isothermal transformation is to hold the steel specimen at the transformation temperature for varying periods of time and then quench in water. Changes in hardness serve as an indication of the rate of transformation. However, this method cannot accurately determine the end of bainitic transformation when austempering. Hardness alone fails to indicate whether small amounts of austenite are still present. Retained austenite should be held to a minimum if maximum physical properties and dimensional accuracy are to be attained.

With the greatly expanding use of martempering and austempering in heat treating, the Schaaber Dilatometer offers many product control possibilities such as (1) more accurate and quicker determinations of transformation time for austempering; (2) martempering time cycles available before transformation begins; (3) the severity of the quenching medium.

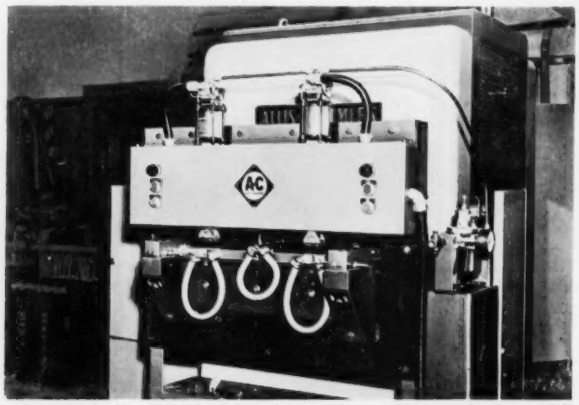
New Two-Station Fixture for Induction Heaters

Allis-Chalmers Mfg. Co., Milwaukee, Wisc., has a new two-station, air-operated, electrically controlled fixture which permits the use of two identical or different work coils for its 10 and 20-kw induction heaters.

Essentially, the two-station fixture provides two separate sets of bus bars to which work coils can be connected. While one work coil is supplying thermal energy to the metal parts being heated, the operator can unload and reload the other work coil. The same amount of work can be performed with one heater that would normally be done with two installations.

It is possible with the two-station fixture to obtain a 100 per cent duty cycle at full load if the time periods for heating and reloading are equal.

The control system of the two-station fixture prevents switching the radio frequency power from one coil to another during the heating cycles. A carefully

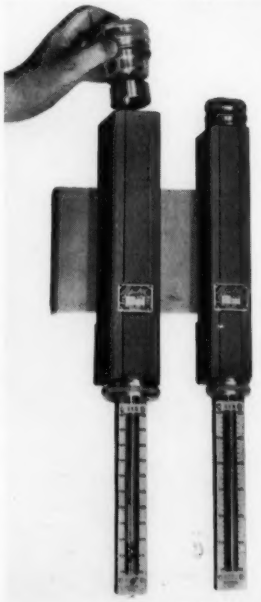


designed timing system is used to insure only cold make and break contacts.

The two-position fixture is designed to be bolted to the front of any standard Allis-Chalmers 10 or 20-kw induction heater. However, some of the early model heaters may require minor modifications, such as providing bolt holes.

Flow-Meter with Built-In-Control-Valve

Waukee Engineering Company, Milwaukee, Wisconsin, manufacturer of flo-meters for measuring flow rates of industrial gases and air, has announced a built-in-control-valve version of the standard Waukee flo-meter. Valves are located at top of meter for easy and quick reading. This features makes installation of meter simple as there is no need to drill special holes for control valves when equipment is to be panel mounted.



Oil contained in the glass tube prevents the accumulation of dirt and other foreign matter which obscure the reading. Cleaning is easy, and can be completed in less than two minutes.

Meters are available for measuring air, ammonia, butane, carrier gas, city gas, dissociated ammonia, endothermic gas, exothermic cracked (rich), exothermic cracked (lean), hydrogen, natural gas, oxygen, propane and purging gas.

(Continued on page 12)

You Can Get Better, Lower Cost Processing of Stainless Steel—These Three Ways:

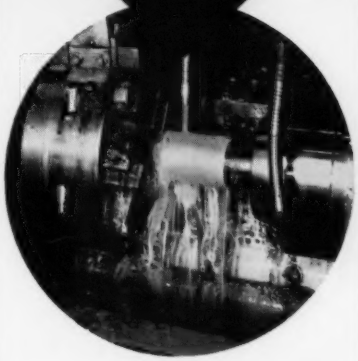
HEAT TREATING

You get more precise heat treating with Houghton Liquid Heats.

Our salt baths devised for stainless steel treatment will preserve the surface. They eliminate danger of inter-granular corrosion, oxidation or other attacks. Heating of parts is uniform and fast.

Houghton salts are carefully compounded to meet predetermined specifications and to remain stable.

MACHINING

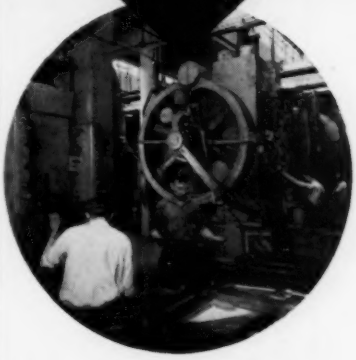


Your machines can turn out better parts, faster, with Houghton Cutting Fluids.

Including highly fortified straight cutting oils for slow speeds, and concentrated bases, both oil- and water-soluble types.

Special emphasis is laid on Antisep All-Purpose Base, used in water emulsions and fortified to provide the lubricity, film strength and anti-welding properties required for machining stainless.

FORMING



Houghton Houghto-Draws assure better finished formed parts, longer die life.

Whether your draws are deep or shallow, simple or complex, there is a Houghto-Draw compound ideally suited to your job. It will provide the film strength and controlled lubricity required for the simplest or toughest drawing job.

Applied by brush, spray or dip, according to your requirements.

For more economical, uniform and productive fabrication of stainless, be sure to take advantage of the metalworking know-how and processing products of Houghton. Call the Houghton Man, or write us, outlining your problem. We'll be glad to help. E. F. Houghton & Co., 303 W Lehigh Ave., Philadelphia 33, Pa.

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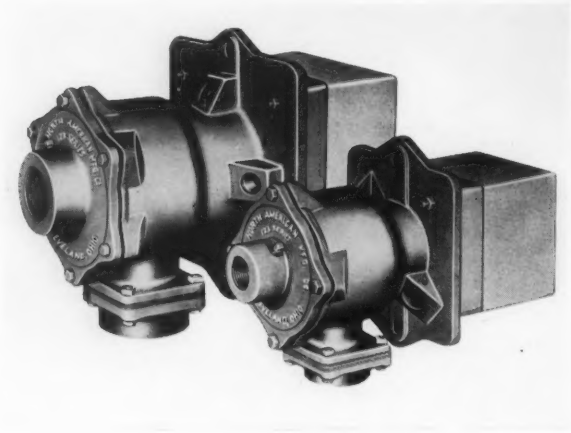
E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

New Gas Burner

North American Manufacturing Co., 4455 E. 71st St., Cleveland 5, Ohio, has introduced a new, nozzle mixing type of burner called the Series 123 XSA Gas Burner. It is offered in five sizes, and shipped with mounting and tile already assembled in an integral unit. The tile is firmly cemented into a cast iron jacket 1¾" deep, and then held securely in place



with hooks to prevent any leaking between the tile and casting, which would cause the furnace shell to overheat and buckle. The burner has provision for a standard North American pilot system, and a conduction type flame safety device may be added at the factory.

XSA Burners have a high effective turndown, making them ideal for installation on multiple purpose furnaces. A furnace equipped with these burners can be operated at temperatures from 400°F. up to 1800°F.

The burners may be operated with air pressures ranging from 0.1 to 16 oz. at the burner, giving a wide choice of capacities from 28,000 Btu per hr. to 2,620,000 Btu per hr.

Foxboro Establishes New Instrument Firm in Mexico

Announcing the organization of a Mexican affiliate, Graficas y Instrumentos, S. A., The Foxboro Company of Foxboro, Mass., enlarges its international service. The new firm, located in Mexico City, has been incorporated for the future manufacture and assembly of instruments and instrument supplies. Its engineers, graduates of Foxboro's extensive training courses, will handle all types of repair work, from simple adjustments to major overhaul.

The new concern has obtained factory facilities adjacent to Schultz y Cia, Foxboro's sales representatives in Mexico, establishing close co-operation between the two companies and insuring quick, convenient service for instrument users in Mexico. Already in full production is the chart department, printing charts for all types of recording instruments.

Cutting Steel with Heat Treated Meehanite Metal

The effect of flame hardening lathe bedways is shown below as a lathe bed segment fashioned into a

cutting tool turns 1112 bar stock. The demonstration took place on a Cincinnati Tray-Top lathe during the Open House sponsored by Cincinnati Lathe & Tool Co., Cincinnati, O., for its dealers recently. Tray-Top and Model LT lathes are available with vees and flats of Meehanite castings, flame hardened and ground. The hardness pattern of the segment shows up in the photo as a dark area.

New Industrial X-Ray Unit

A new portable industrial X-ray unit that fits into the trunk of an automobile and is designed specifically for rapid inspection of welds, pipe lines, power

plant, ship and aircraft equipment, is available from the X-ray Department, Non-Destructive Testing Division, North American Philips Company, Inc., 750 South Fulton Avenue, Mount Vernon, N. Y.

(Continued on page 14)

wherever you are...

it's still the same

And that goes for Crucible's REX High Speed Steels, too. For all of REX High Speed Steels are subjected to extensive metallurgical tests – microscopic examinations, chemical analysis, ultra-sonic checks both in the billet and finished form, magnetic analysis, and strength tests – to assure you of uniform quality regardless of when or where you buy them.

This *uniformity factor* distinguishes Crucible's REX High Speed Steels from other brands. Next time you order high speed steel, be sure you consider this all-important factor. When you do, we're sure you'll specify the Crucible REX brand.

WRITE TODAY for the unique Crucible Tool Steel Selector, 9" diameter, in 3 colors – a twist of the dial tells you which tool steel is best for your application. Address your request to Crucible Steel Company of America, Dept. MT, Oliver Building, Pittsburgh 22, Pa.

Rex® High Speed Steels
Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
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YOUR TOOL STEELS
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CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking

TOOL STEELS

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News to Heat Treaters (cont.)

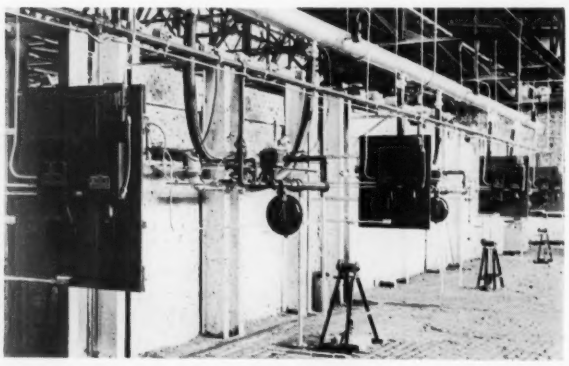
The new unit is unique since the X-ray tube head also contains the high tension generator of 150,000 Volt output. It weighs only 143 lbs. The accompanying control is equally compact and weighs only 80 lbs. The complete MG 160 equipment weighs only 223 lbs. The novel arrangement of tube and generator in one housing eliminates the need for high tension cables, always a possible source of trouble.

The X-ray tube is fan-cooled and has an end port which provides maximum usefulness in handling various types of "close-in" work. Combination tube and generator unit has a diameter of only 10⅝" and is 35" long. Where desired, the diameter can be reduced to 8½" by eliminating the removable guards. Power supply for the unit can be either 115 or 230 volts a.c. Current drain is 20 amperes.

Annealing Furnaces Converted from Coal to Natural Gas

As part of an extensive modernization program in manufacturing methods to streamline production, undertaken by the Moline Iron Works, Moline, Illinois, eleven of their malleable iron annealing furnaces each of 25 tons capacity have been converted from coal to natural gas firing. Previously the furnaces had been hand coal fired with the usual attendant variations in performance. Dirty, dusty piles of coal, placed at each furnace, made it impossible to keep the plant clean. Operation was very uneconomical.

After a careful combustion engineering survey, the existing furnaces were modified and converted to gas firing with Hauck low pressure air-gas proportional mixers and Hauck "Retain-a-Flame" burners. The mixers have single valve control. In addition, flame safety equipment, consisting of Wheelco Flame-o-trol units, flame rods, and Hauck spark-gas pilots provid-



ing push-button starting of burners were incorporated into the gas burning system. Accurate control of heat input is easily obtained.

The changeover from coal to gas firing has drastically reduced fuel cost, increased output, produced more constant furnace temperature and consequently, more uniformly annealed castings and better quality of work. A reduction of 24 hours in the firing cycle has been effected. The furnaces are brought up to maximum temperature 20 hours sooner than with hand fired coal heating. Pot life has also been increased.

Labor requirements for furnace operation, supervision and maintenance are now considerably less. The atmosphere in the vicinity of the furnaces is much cleaner and more healthful. There has been a decided reduction in furnace repairs. The furnaces have been attractively painted white and aluminum. Soot and smoke are gone. Accumulation of fly ash is no longer a problem, eliminating the necessity for periodic removal of accumulated ashes.

Hydraulic Shovel Facilitates Handling of Bulk Forgings

An unusual method of handling bulk forgings is speeding operations at the Detroit Gear Division of the Borg-Warner Corp. of Detroit, Mich.

A fork-lift truck equipped with an Allen hydraulic

lift-truck shovel, unloads a 24,000 lb. truckload of forgings in ¾ to 1½ man hours. Previously the unloading job required from 16 to 18 man hours, at a capacity of two truck-loads per day.

Savings at Detroit Gear, based on the above figures, amount to approximately 150 man hours each week, over 7,000 man hours in a single year.

The fork-lift truck is driven onto the highway truck-trailer at the receiving dock, and scoops up the forgings. A fingertip hydraulic control tips the shovel back so the load may be carried to tote boxes without spillage and also gives the operator full control over the speed of dumping the shovel. The tote boxes are filled with forgings, and taken to the production machines for processing.

(Continued on page 22)

HOLDEN ELECTRODE FURNACES

LEASE VERSUS PURCHASE

HOLDEN METALLURGICAL PRODUCTS

Lease benefits:

1. No capital investment.
2. Totally expensed from operating profits.
3. Complete write-off of wiring costs over term of lease.

TYPE 401-4
Marquenching-Austempering Unit

TYPE 701-4
Submerged Electrode Furnace with removable electrodes.

BENEFITS OF MARQUENCHING AND AUSTEMPERING:

1. Less distortion. **2. Improved wearing properties.**
3. Improved physical properties.

WRITE FOR 7-PAGE AUSTEMPERING-MARTEMPERING BULLETIN

NEWS! NEWS! NEWS!

HOLDEN MARQUENCHING #296 **MELTING POINT 295°F.**

1. This new salt contains a coagulating material which separates out chlorides.
2. Your melting point and quenching rate can be maintained under any production operating conditions.
3. Any sludges are easily removed as soft residual material.
4. This product can be used in Holden Marquenching units and competitive furnaces.

IMPORTANT: We can supply our Marquench Additive #356 which can be added to your present salt quenching furnace as a separate item as a coagulant. Therefore, you can buy the coagulating material for competitive quenching salt baths and similarly add the new Holden Marquench #296, which will definitely eliminate your throwing away the quenching salt, and at the same time, obtain more uniform quenching.

Three f.o.b. points: Detroit, Michigan—New Haven, Conn.—Los Angeles, Calif.

THE A. F. HOLDEN COMPANY

P.O. Box 1898
New Haven 8, Conn.

3311 E. Slauson Ave.
Los Angeles 58, Calif.

11300 Schaefer Highway
Detroit 27, Michigan

Institute News . . .

SPRING MEETING—1953

The Spring Meeting at the Hotel Shamrock in Houston was undoubtedly the largest and most successful to date. Over 100 persons representing 50 companies were on hand to hear the speakers for the occasion, discuss Institute business affairs and see a part of Texas.

Most of the details of the meeting have already been covered, as in the humorous release from a "Texas Reporter" but the photographs here attest the fact that attendance was very good and Houston received the MTI in a Texas manner.

Much of the success for this meeting is due to Vice President Cliff Cook, his brother Carl, and their charming wives. All in attendance expressed their appreciation of the time and energy they put into the necessary preparations.

The opening day was launched with a family get-together breakfast, a new idea suggested by Cliff Cook and one which proved outstandingly successful. A feature of the breakfast was a surprise comedy act in which a bedraggled "Oakie," Cousin of Al Cox and his wife Helen, appeared to attend the "meetin' service." She provided the group with a laugh-a-minute and started the session off in a spirit of good humor and fellowship.

After the breakfast the group adjourned to hear Howard Scott of Westinghouse Electric and Manufacturing Company present a very interesting talk on the subject of "New Heat Treating Methods for Alloyed Materials."

For the balance of the meeting, mornings were devoted to business sessions, afternoons to fun and recreation. The Monday afternoon visit to a ranch for a Texas barbecue, swimming, dining and dancing for which the Cooks were host was a high point and greatly enjoyed by all.

The next day Charles Lewis of Cook Heat Treating Company of Texas presented an extremely interesting discussion on the subject of "Quality Control in the Commercial Heat Treating Plant." This was followed by another highlight of the meeting, an in-

(Continued on page 20)

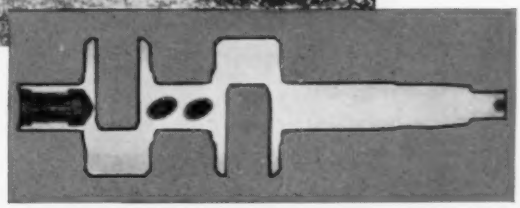
The annual Spring Meeting banquet at the Hotel Shamrock, the last group gathering before leaving the grandeur and super-hospitality of Texas.

The Evinrude Story:

Salt bath treatment improves product . . . reduces cost in crankshaft production

Savings in machining and grinding operations, due to reduced distortion, are greater than the entire heat treating cost!

Evinrude's new Super Fastwin 15-h.p. outboard motor.



EVINRUDE CRANKSHAFT—Carburize in Park-Kase 1 for 2¾ hours at 1750°F. Case Depth .045". Transfer to Park Nu-Sal Neutral Salt at 1450°F. followed directly by Iso-thermal quench in Park's Thermo-Quench Salt.

AT Evinrude Motors, they combine Park-Kase liquid carburizing and Iso-thermal quenching and tempering into one continuous operation . . . with all processes performed in the same furnace line.

The crankshafts are immersed in Park-Kase liquid carburizer to produce the desired case . . . then transferred to Park Nu-Sal neutral salt at above the critical before the Iso-thermal treatment in Park Thermo-Quench Salt.

RESULTS: a hard case covering a tough core! Valuable production time is saved! But that's not all—

- Less distortion allows less final machining
- Metallurgical properties of part improved
- Process does not require skilled help
- Operate either manually or mechanically
- High capacity per unit of floor space
- Low investment per unit of production

The results are the same at Evinrude as they are wherever Park salt baths and technical assistance is used: quality is improved . . . production is increased . . . manufacturing costs are lowered!

Second in a series of advertisements describing Park processes on the job.

• Liquid and Solid Carburizers • Cyanide, Neutral, and High Speed Steel Salts • Coke • Lead Pot Carbon • Charcoal • No Carb • Carbon Preventer • Quenching and Tempering Oils • Drawing Salts • Metal Cleaners • Kold-Grip Polishing Wheel Cement

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8076 Military Avenue • Detroit 4, Michigan

☐ Send for free bulletin on Deep Case Liquid Carburizing.

Name_____ Position_____

Company_____

Address_____

City_____ State_____

DO YOU KNOW WHAT HEAT TI

If you now do your own heat treating—or are contemplating the installation of a heat treating department – have you carefully considered all of the costs involved? Each of the following factors must be given careful consideration:

LABOR

Trained operators require years of experience, without them you cannot expect satisfactory heat treating. Can you afford men of this caliber for the amount of heat treating you require?

PLANT SPACE

Does your present department have enough space to work efficiently? If planning a new department, will it require an addition to your plant?

MAINTENANCE

Equipment must be kept in constant repair to prevent rapid deterioration What does it cost you or what will it cost you?

INSURANCE

What has the installation of heat treating department done to your insurance rates? What can you expect if you are planning a new department?

EQUIPMENT

Can you economically install sufficient equipment to handle all of your requirements for hardening, annealing, carburizing, nitriding, etc., or can your present equipment handle all these operations with successful results? Is your capacity flexible enough to handle peak loads?

SUPPLIES

Gas, electricity, chemicals—an endless variety of materials are needed continually. Are you wasting money due to insufficient work to keep all equipment going? Closing down and re-heating furnaces is an expensive waste.

TESTING EQUIPMENT

A constant check on heat treating operations and results is required to maintain quality and uniformity. Add this to the cost of your equipment along with skilled operators.

These are the major items to be figured into the cost of your own heat treating department—there are others which arise in special cases.

The problems listed here have been faced and overcome by commercial heat treaters. They know the answers because heat treating is their business—just as the manufacture of your products consists of solving numerous problems in your business.

If you are faced with heat treating problems or the need for heat treating services write

METAL T
271 NO

REATING COSTS
— *When You Do Your Own* ?

For the BEST in Heat Treating Consult these Companies:

CALIFORNIA

California-Doran Heat Treating Co.
2850 E. Washington Blvd., Los Angeles 23
Cook Heat Treating Corp.
5934 Alcoa Ave., Los Angeles 11
Hollywood Heat Treating Co.
1046 No. Orange Drive, Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood
Dexter Metal Treating Co.
1026—77th Ave., Oakland 21
Industrial Steel Treating Co.
1549—32nd St., Oakland 8

COLORADO

Metal Treating & Research Co.
4110 Fox St., Denver 16

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

ILLINOIS

Senecca Heat Treating Co.
70 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Chicago Steel Treating Co.
333 North California, Chicago
Dura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47
Lindberg Steel Treating Co.
222 North Laflin St., Chicago 7
Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50
Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kenzie St., Chicago 22
American Steel Treating Co.
P. O. Box A, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Love Park
O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford
C. U. Scott & Son, Inc.
1510 First Ave., Rock Island

INDIANA

Nerl Heat Treat Corp.
1824 So. Franklin St., South Bend 23

MARYLAND

Maryland Tool Company
111-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
9 Alger St., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Acme Steel Treating Co.
119 Lieb St., Detroit 7
Anderson Steel Treating Co.
1337 Maple St., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Michigan Steel Processing Co.
3120 Denton, Detroit 11
Standard Steel Treating Co.
3468 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
American Metal Processing Co.
12000 East Nine Mile Road, Van Dyke

MINNESOTA

Metallurgical Control Labs.
900 East Hennepin, Minneapolis 14

MISSOURI

Metallurgical, Inc.
1915 Tracy Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth
American Metal Treatment Co.
Highway 25 and LaFayette St., Elizabeth
Benedict-Miller, Inc.
Marin Ave. and Orient Way, Lyndhurst
Bennett Steel Treating Co.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Metro Heat Treat Corp.
466 Broome St., New York 13
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E., Rochester 5
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave., Cincinnati 27
Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1265-71 East 55th St., Cleveland 14
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16
Dayton Forge & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher
J. W. Rex Co.
834 West Third St., Lansdale
The Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 East Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
4272 Wissahickon Ave., Philadelphia 32
Ferrotherm Company
4911 Butler St., Pittsburgh
Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wesley Steel Treating Co.
1301-1403 West Pierce St., Milwaukee
Harris Metals Treating Co.
1635 Murray Ave., Racine

REATING INSTITUTE

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MASTER CRAFTSMEN

or consult the MTI members listed above

This is the sign which greeted members as they arrived at the Hotel Shamrock.

teresting tour of the San Jacinto Battleground and a visit to the Monument (taller, of course, than Washington's), and Museum; an inspection of the old Battleship Texas which is permanently anchored in the park, followed by a delicious, Texas-style seafood and fried chicken dinner at the famous San Jacinto Inn.

Business sessions were concluded Wednesday noon after which the group boarded buses for a conducted tour of the heat treating department of the Hughes Tool Company, one of the largest in the country. Many interesting things were seen and as members pointed out, ideas secured that would be useful "back home."

MTI SPRING MEETING—1954

Arrangements have been completed to hold the 1954 MTI Spring Meeting at The Homestead, Hot Springs, Virginia, April 5-7, 1954.

MTI ANNUAL MEETING—1953

All arrangements have been completed for the Annual Meeting of the MTI which will be held at the Hotel Carter, Cleveland, Ohio, October 16, 17 and 18, 1953. On June 26th a meeting of the Annual Meeting Committee, Chairman C. W. Derhammer, was held at the Lake Shore Country Club in Cleveland to discuss various details. This meeting was attended by President A. M. Cox and Secretary Herington. The Committee is actively providing their cooperation and assistance in getting things established.

METLAB COMPANY CELEBRATES QUARTER CENTURY

Several hundred guests were entertained at the plant of the Metlab Company in Philadelphia, during a two-day Open House on May 28th and 29th, celebrating the 25th Anniversary of its founding.

Following conducted tours through the plant, which employs about 100 persons and covers 36,000 feet of floor space, with six acres of ground, the visitors gathered on the Company's recreation field where the more active engaged in volleyball, badminton, table tennis and quoits. Liquid refreshments were served during the afternoon.

A center of interest was the private swimming pool just opened for the season. The address of the plant, 1000 E. Mermaid Lane, has been publicized by the slogan—"One Grand Mermaid." Not one, but three, attractive mermaids gave an exhibition of fancy swimming and diving.

By happy coincidence Horace Knerr, the founder, became father of his first (and only) daughter when the Company was started 25 years ago, and his first (he hopes not only) granddaughter in its 25th year. Both ladies attended the Open House. In fact, the Knerr family turned out in force to celebrate the occasion, as may be seen in the group photograph.

Metlab Company was founded in 1928 when operations were begun in a small plant in Philadelphia for the heat treatment of structural parts for aircraft. In 1937 the company expanded its facilities to cover all kinds of commercial heat treating.

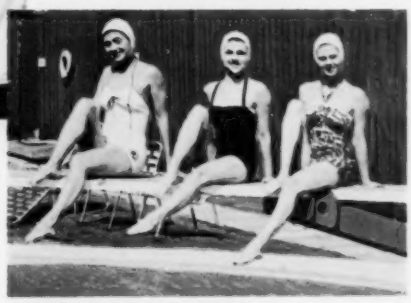
We are certain the entire Institute joins in extending congratulations to Mr. Knerr for this twenty-fifth year achievement, along with the hope that Metlab Company will continue to enjoy the success it has achieved based upon Quality and Service.

Entrance to Metlab plant.

25th Anniversary.

Metlab's founder, Horace Knerr, and daughter Nancy (Mrs. Wm. Kupper), born when the Company was started.

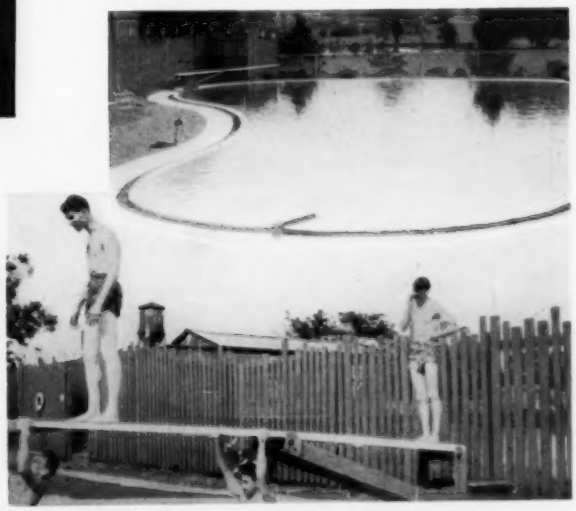
A group of guests at the Open House, "inspecting" the Inspection Department.



Metlab Mermaids, Misses Pam McCullen, Lorraine Pauro, Doris Zimmerman.

A quarter century and three generations—seated, left to right, Mrs. Conrad Knerr holding daughter Andrea, Mrs. Horace C. Knerr, Mr. Horace C. Knerr, Mrs. William Kupper (Nancy Knerr). Standing, Conrad H. Knerr, Theodore Knerr, and Mr. William Kupper. Inset, Barry Knerr, who was pursuing his studies at the University of Pennsylvania when this picture was taken.

Mr. Frank Tatnall, center, discussing latest developments in stress analysis during a meeting of the Philadelphia Section of the Society for Experimental Stress Analysis, recently held at the Metlab plant.

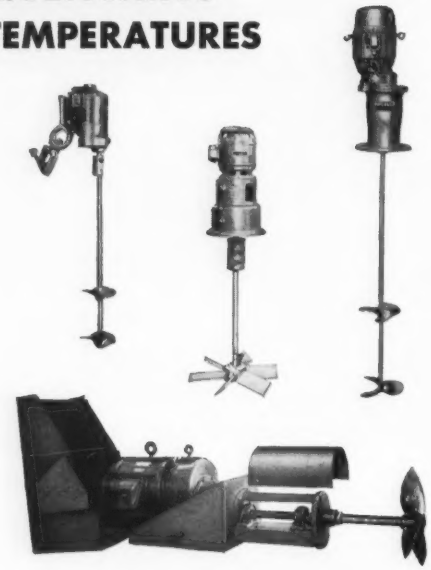


Members of the Society for Experimental Stress Analysis cooling off after a technical session on Residual Stresses.

DEVINE AGITATORS

ASSURE

UNIFORM QUENCHING TEMPERATURES



- Provide proper circulation of quenching liquid.
- Help equalize quenching strains.
- Compact. Self-contained. No piping required.
- Unusually sturdy. Built for plenty of use.
- Easy to install. Easy to detach. Easy to maintain.

Devine Engineers will be glad to recommend a type and size to fit your tank.

J. P. DEVINE MFG. CO.

A. M. Cox, President

49th St. and AVRR · Pittsburgh 1, Pa.

Devine AGITATORS

News to Heat Treaters (cont.)

New Electrode with Flame-Hardening Deposit

A new welding electrode, designed for build-up work and hard-surfacing applications wherein the deposited metal can be machined or flame hardened, has been announced by the General Electric Company's Welding Department. The new electrode, designated G-E Type W-98, is a heavy covered flame-hardening rod that can be used in all positions.

The W-98 can be used in build-up work on road machinery parts, gears, pinion teeth, pump housings, shafts, sprockets, ship hawse pipes, and so forth. It is recommended where a higher hardness deposit is desired than that obtainable with electrodes used for under layers. Although the type of material involved and the welding conditions can greatly affect the hardness of the deposited metal, generally the hardness will be approximately 250 Brinell as welded and it will flame harden to about 350 Brinell.

High Temperature Vacuum Furnace

The K. H. Huppert Company, manufacturers of electric furnaces and ovens, 6830 Cottage Grove Avenue, Chicago 37, Illinois have designed a new type high temperature electric vacuum furnace, called their "Airfre" model.

This furnace has been designed for production and laboratory use where temperatures up to 2500°F. and vacuums up to 29" are required; higher vacuum equipment for special application can be supplied. Furnace and vacuum system can be used independently of each other if desired.

The "Airfre" furnace is built in a large number of different sizes, and is complete with vacuum pump, and other necessary control equipment such as gauges, automatic pressure controller, variac, ampere meter, timer, and automatic temperature controller completely wired ready for operation.

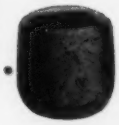
This photograph of the furnace was taken in the Vapor Heating Corporation plant showing a man removing a tray of vapor mercury contact thermostats which have been annealed to remove the stresses in the glass tube caused by welding tiny wires across the orifice of the tube.

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

FOR 81 MM MORTARS—Steel slugs, at left, are cut from 2½-in. round bars of carbon steel; next, the slugs are upset (center).



Heated to 2100 F, the upset slugs are extruded and formed into rough cups (right). The final product, not shown, is then cold-shaped to close tolerances.

SCENE OF ACTION—In this 1600-ton press, the upset slugs, heated to 2100 F, are cupped by the extruding punch at upper right. The forming die, at upper left, then shapes the cupped piece to more accurate shape. High-pressure jets of mixed air and water keep the punches and dies cooled to about 550 F. Punches and dies, made from Cr-Mo-W tool steel, are hardened and double-tempered to produce a hardness of Rockwell C-50.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Care is required when cutting tool steel with abrasive wheels.

Cutting annealed tool steel with an abrasive cut-off wheel can cause both fine cracks and scorching on the surface unless certain precautions are observed.

Proper wheel speeds and the liberal use of coolant will help to avoid this sort of trouble. If these precautions are ignored, the excessive heat generated is often so intense that an annealed steel is actually hardened.

If the steel is heated above the critical range, the rapid conduction of heat to the adjacent cold steel serves as a quench. Hardnesses above Rockwell C-60 are often produced on surfaces which have been cut in this manner. Attempts to drill or machine such surfaces will result in trouble because the hardness is often high enough to make machining impossible.

An experienced spark-tester can identify the basic composition of this bar of tool steel. Can you?

Slugs Formed Into Mortar Shells 500 an Hour, at 2100 F

Production men at the Ordnance Division of Rheem Mfg. Co., San Pablo, Calif., have good reason to be pleased with the long service life they've been getting from extrusion punches and forming dies made from our Chrome-Moly-Tungsten hot-work tool steel.

Hot slugs, to be processed into mortar shells, are extruded into a cupped shape by punches at the rate of 500 an hour. Because they are in such frequent contact with the slugs, heated to 2100 F, the temperature of the punches seldom falls below 550 F, even though the punches are sprayed with an air and water mixture.

The production men and tool designers at Rheem figured the punches would produce a maximum of 3,000 to 5,000 pieces before failure. Instead, one punch extruded 30,860 pieces; others produced 14,000 and 16,000.

The hot-forming dies, which form the cupped piece into more finished shape, are subjected to the same high temperatures. After forming 15,000 cups, one of these dies was polished and put back in service; it turned out another 63,000 pieces before it showed much wear.

Cr-Mo-W is an all-around hot-work steel containing 5 pct chromium. It's especially suited for jobs that involve both shock and repeated cycles of heating and drastic cooling. It's easy to machine and heat-treat; and it's highly resistant to heat-checking when water-cooled.

Cr-Mo-W hardens in air and distorts very, very little during heat-treatment. It's widely used for gripper and header dies, shear blades, trimmers, die-casting dies. Like to have more details? Write for Booklet 265. Address your request to Publications Dept., Bethlehem, Pa.

KNOW YOUR SPARKS

The exact composition of a tool steel cannot be determined except by a laboratory analysis. However, the spark test is often convenient when bars of several different compositions become mixed.

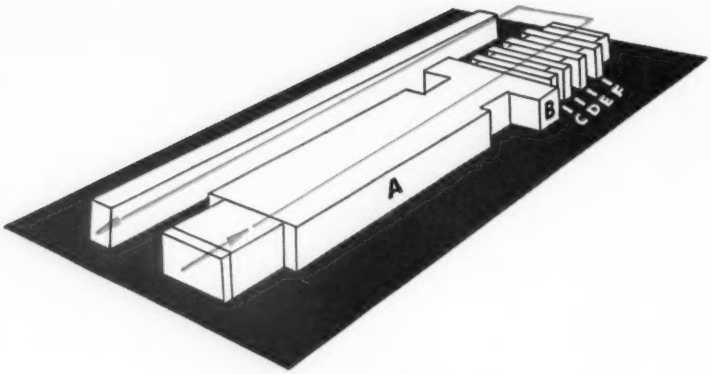
Even amateurs sometimes use the spark test with good results by spot-grinding a bar of known analysis and comparing the spark stream with bars of unknown composition. A small-diameter grinding wheel, rotated at high speed to produce a generous flow of sparks, is recommended for this test. Note the illustration.

Some elements such as carbon, tungsten or molybdenum have characteristic appearances in the spark stream. Other elements such as silicon and nickel modify the appearance of other elements.

Perhaps you are expert enough to recognize the sparks at the left. They indicate a steel having a fairly high carbon content (0.90 pct) and some tungsten (0.50 pct). It's our BTR, most popular of the general purpose, oil-hardening grades.

Heat Treat Furnace Layout

by Holcroft... 2nd of a Series



A Annealing furnace
B Hot salt quench
C Wash
D Acid bath
E Wash
F Oil dip

Volume Production Castings

Annealed, Descaled, Desanded

This "U-type" furnace layout by Holcroft ties right into the production line of a large automotive plant.

The unit anneals, descales and desands 10,000 pounds of castings each hour. After annealing, the stock is dipped in a salt quench, rinsed in water, bathed in acid, water-washed again, and dipped into a soluble oil to prevent rust. A return conveyor automatically brings the trays back to the loading point.

Unusual layouts like this present no particular problem for Holcroft. After all, it's an inherent part of the job to be completely responsible for the work—from the time it is to be heat treated to the time it's ready for finishing operations. It's the type of work Holcroft does well. Holcroft & Company, 6545 Epworth, Detroit 10, Michigan.

BUILT BY HOLCROFT & COMPANY DETROIT-MICH

PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO 9
J. H. Bradley, A. A. Engelhardt
4209 South Western Blvd.

CLEVELAND 15
Wallace F. Schott
1900 Euclid Ave.

HOUSTON 1
R. E. McArdle
5724 Navigation Blvd.

CANADA
Walker Metal Products, Ltd
Windsor, Ontario

EUROPE
S. O. F. I. M.
Paris 8, France

HEAT TREATING HINTS

Bright Tempering with Cast Iron Chips

Every so often the heat treater is compelled to retemper hardened and tempered, finish ground or polished dies, tools or machine parts. The surfaces of these parts will seldom be seriously affected if the retempering temperature required is approximately 700°F. or less. Higher temperatures, i.e. 900°-1200°F. may cause serious damage or complete loss if accurate dimensional tolerances are required. Bright finishes will oxidize severely and may even pit, necessitating a repolishing operation.

Sodium nitrate or nitrite tempering baths at 900°-1200°F. can scale or pit the work just as much or more than hot air recirculating ovens and the use of special salt compositions for this temperature range is often impractical if a wide variety of steels or sizes are being treated.

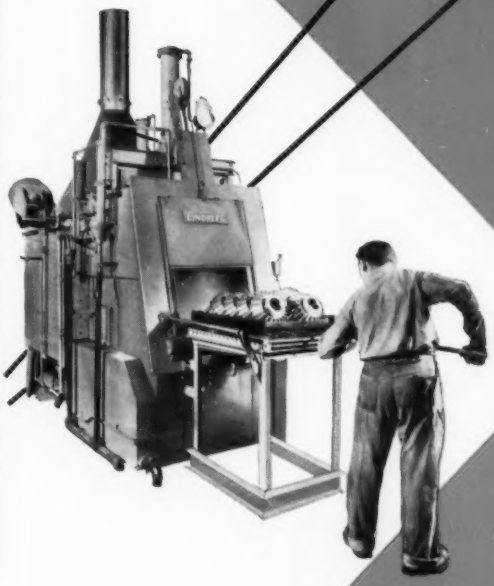
Sealed retort atmosphere furnaces using either endothermic, exothermic or cracked ammonia gas are well able to do bright tempering if production and economy warrant such a large capital outlay. In the majority of cases bright tempering is an expensive operation if the parts are only an occasional job.

It is quite practical, however, to bright temper parts by packing in new, clean, cast iron chips in the same manner as if the parts were being pack annealed. The items to be bright tempered should be free of contamination and oil. Before packing it is good practice to warm the items to approximately 250°F. The sealed container of cast iron chips and work is charged into a hot air recirculating oven and held at the proper temperature for a sufficiently long time to insure thorough soaking. The container may be removed from the furnace and air cooled but under no conditions should the parts be removed from the box until they are below approximately 350°F.

F. Heinzelman, Jr.
Fred Heinzelman & Sons
New York, New York

5 FURNACES IN ONE

the *LINDBERG* Carbonitriding Furnace



Yes, it's many furnaces in one! It's designed not only for carbonitriding . . but also for hardening, carburizing and carbon restoration. It's self contained . . it's easy to maintain!

10 reasons why Lindberg Carbonitriding Furnaces are better:

1. Heating is by new type, gas-fired, vertical radiant tubes. They weigh only 29 pounds each . . can be changed in two minutes. Just lift out the old one, and lower the new one in its place.
2. Vertical radiant tubes last longer . . often two or three times as long.
3. Quench tank is built-in . . no costly excavation or piping necessary. Distortion is minimized because quenching takes place within furnace structure, and heated work is never exposed to outside air.
4. Quench tank has fin type oil cooler . . maintains oil at proper temperature for quenching.
5. Specially designed purge chamber purges work loads before they enter heating chamber.
6. Special check-light system tells you where charge is at any given time.
7. Control of heating and quenching cycle is automatic. Uniform case depth is assured because each charge remains at heat same length of time.
8. Depending on your production requirements, Lindberg Carbonitriding Furnaces are made for automatic, semi-automatic, or manual charging.
9. You're not experimenting with Lindberg Carbonitriding Furnaces. They've been tested . . under three years of rough operating conditions.
10. The famous Lindberg "Hyen" generators which supply atmosphere for Lindberg Carbonitriding Furnaces are instantly adjustable for many different types of atmospheres.

For full details, ask for bulletin #241.

LINDBERG FURNACES

Lindberg Engineering Company • 2466 West Hubbard Street • Chicago 21, Illinois

ROLOCK

FABRICATED ALLOYS

HEAT AND CORROSION RESISTANT

LEFT: Parts entering roller hearth furnace on "Serpentine" trays.
BELOW: "Serpentine" trays on loading table.

"SERPENTINE" DESIGN *minimizes* WARPAGE...

LOWERS HOUR-COSTS FOR FURNACE TRAYS AT

PRATT & WHITNEY AIRCRAFT

Rolock "Serpentine' furnace trays are carrying jet engine parts through a Westinghouse roller hearth furnace with an Exothermic atmosphere at maximum temperature of 2050°F.

Rolock quoted on another type of tray as well as the "Serpentine," but 100 "Serpentine" trays were purchased for original equipment and have so far had many months of continuous use . . . with additional orders placed during that time.

The exclusive Rolock Serpentine construction gives freedom to expansion and contraction in both directions, minimizing warping to a greater degree than any other furnace tray Rolock has seen. It is available to order in any practical length, width and depth . . . as a tray or as the base of a basket or crate.

Rolock engineers invite your requests for solution of specific metal treating problems. Our experience covers hundreds of nationally known industrial plants.

HEAT TREATING . . . OR CORROSION RESISTANT CATALOGS ON REQUEST.

Offices in: PHILADELPHIA • CLEVELAND • DETROIT • HOUSTON • CHICAGO • ST. LOUIS • LOS ANGELES • MINNEAPOLIS • PITTSBURGH

ROLOCK INC. • 1232 KINGS HIGHWAY, FAIRFIELD, CONN.

JOB-ENGINEERED for better work
Easier Operation, Lower Cost

4RL53B

WHAT'S YOUR PROBLEM?

ED. NOTE: Frequently "*Metal Treating*" is asked for answers to heat treating problems of various types. These are referred to technicians, metallurgists, etc. The correspondence below is typical.

Send *us your problem*—we'll try to get the answer and publish it for your benefit and others.

June 30, 1953

Dear Editor:

We would like to manufacture a small File 3" long $\frac{5}{16}$" wide and $\frac{1}{8}$" thick in a very fine quality. Your suggestion is very much appreciated as to the type of Steel and the best Hardening of these files.

Please use the enclosed addressed envelope for your answer.

We are readers of your "Metal Treating Institute."

MAX BIESENBACH
Glem Corporation
Hato Rey, Puerto Rico

July 8, 1953

Gentlemen:

Relative to your inquiry regarding the manufacture of files, especially fine ones, this is a highly specialized subject which ordinarily takes years to learn. It is not quite clear if you wish to enter the manufacture of files or simply make up a small quantity for your own use.

Ordinarily it would be much quicker and more economical to purchase these files from any of several leading manufacturers in this Country.

Briefly stated, they would require a good grade of file steel, ordinarily containing about 1.20 carbon or higher. This would be purchased in a suitably annealed state. The files would then be cut.

The files would be heated in a salt bath, or a lead bath, to 1475°F. (or other temperature depending upon the particular steel used), and quenched in brine, leaving the tang out so as to cool slowly.

The file is then immediately straightened while hot, which takes some skill. It is then tempered at about 350-400°F.

Trusting that these comments may be helpful,

Very truly yours,
HORACE C. KNERR, *President*
Metlab Co.
Philadelphia 18, Pa.

Dear Mr. Herington:

In your May-June issue you show micros of carburized SAE 52100 bearing races and describe the carburizing cycle used. Since SAE 52100 is a high carbon thru-hardening bearing steel, I can see no reason for carburizing it and wonder if a typographical error has been made in the report or if this is some new unorthodox heat treatment.

Please let me know.

Very truly yours,

R. H. LAUDERDALE, *Metllurgist*
Northern Ordnance Incorporated
Minneapolis 21, Minn.

Gentlemen:

Mr. Herington, Editor of METAL TREATING, the magazine of the Metal Treating Institute, has forwarded us a copy of your letter to him dated July 2, 1953.

A carburizing of SAE 52100 was specified by one of the bearing manufacturers for whom we ran a test and which micros we happened to use in the article which appeared in the recent issue of METAL TREATING. It is our understanding that the purpose of the carburizing treatment is to increase the Rockwell or Brinnell hardness on the very surface of the bearing to prevent Brinnelling of the surface of the races by the balls of the bearing itself.

We do not know whether this is a common practice among bearing manufacturers or whether it is a wrinkle that was developed or specified for their own purposes by this particular bearing company. We do know, however, that the company that required this treatment produces a very heavy duty and high grade bearing.

When they first suggested the treatment, we were somewhat surprised as I believe you were.

We trust that the foregoing will be of help to you and if there is anything further we can do in connection with the matter, please do not hesitate to contact us.

Very truly yours,

GEORGE C. MCCORMICK
Sales Manager
Industrial Heating Equipment Co.
Detroit 7, Mich.

MISCO *Flexible* **FURNACE HEARTHS**

Heat Resisting · Wear Resisting · Shock Resisting

MISCO B
(25 Cr—12 Ni)
ALLOY HEARTH

Here it is...

An Effective, Economical METAL HEARTH

The Misco Flexible Furnace Hearth is made in simple 4″ x 4″ interlocking units for assembling to any size. Flat on top and strongly ribbed underneath, it will not distort like a large one-piece plate. Any warpage is limited to a 4″ x 4″ local area and is not communicated to the hearth as a whole.

If the underlying brickwork is flat to start with, the Misco Hearth will remain flat and level until the supporting brickwork itself becomes displaced.

The Misco Flexible Hearth resists wear and impact, is shockproof and practically indestructible. It will protect the hearth brickwork up to 2200°F., and can be used over and over again.

Michigan Steel Casting Co.

One of the World's Pioneer Producers of Heat and Corrosion Resisting Alloys

1999 GUOIN STREET
DETROIT 7, MICHIGAN

MISCO
Heat and Corrosion Resistant Alloys

Heat Treating Abstracts

Dual Frequency Induction Heating

In an effort to reduce installation and operation costs of induction heating equipment, a method was developed whereby two frequencies are used in sequence. The first attempt was to find a cheaper source of high frequency power. Mercury vapor tubes seemed advantageous but presented control problems. In the range of 3,000 to 10,000 cycles motor-generator sets appeared best, while in higher frequencies, vacuum tube equipment must be used. One development is the self-excited generator which supplies power in frequencies up to 1,000 cycles on a reasonably efficient and economical basis. Based upon test experience, use of power at low frequencies was established as the first stage of many operations. Coil designs finally developed used power at normal commercial voltages. These low frequencies are providing deeper penetration, uniform heating and savings in capital cost as well as making it possible to uniformly heat objects with varying sections.

Parts can be heated with 60 cycle power to just below the Curie point and then brought to forging temperatures with high frequency power. It has been found that 60 cycle power can be used to bring 6 inch square billets to forging temperatures, thus eliminating the need for generators. At one installation made by General Engineering Co., Ltd., Toronto, 3¼ inch square billets are heated to forging temperature by using duel frequency. In the first coils, the billet is raised from room temperature to about 1400°F. using 3 phase 60 cycle power at 575 volts. The billets then pass through the high frequency coils operated at 3,000 cycles where they are raised to 2200°F. for forging. Normal production is 200 billets per hour. Power consumption is about 800 KW. In this one application, the cost of heating proved to be less than the cost of heating with oil due to a saving of steel formerly lost by scaling.

Another application has been the heat treating of hollow shells with a thick base and thin tapering walls where uniform heating was required. Shells are sent automatically through a machine where the first coils raise them to about 1400°F. In the high frequency coils the shells are heated to about 1550°F. prior to quenching. A maximum of 17 shells are in the machine at one time; floor space is only a small fraction of that required for oil burning equipment.

(Abstracted from "Dual-Frequency Induction Heating Lowers Process Costs" by R. S. Segsworth, *The Iron Age*, April 16, 1953.)

Tempilstiks°
quick, simple, accurate way to tell temperatures
use like a crayon
to control working temperatures in:
• welding
• flame-cutting
• tempering
• forging
• casting
• molding
• drawing
• straightening
• heat-treating in general
$2 each
gives up to 2000 readings
It's this simple: mark the workpiece with the proper Tempilstik°. When the mark melts, the specified temperature has been reached.
Available in these temperatures (°F)
113 125 138 150 163 175 188 200 213 225 238 250
263 275 288 300 313 325 338 350 363 375 388
400 450 500 550 600 650 700 750 800 850 900
950 1000 1050 1100 1150 1200 1250 1300 1350 1400 1450
1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000
Also available in pellet or liquid form.
FREE —Tempil° "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.
Metal & Thermit Corp. 100 E. 42nd Street, New York 17, N. Y.

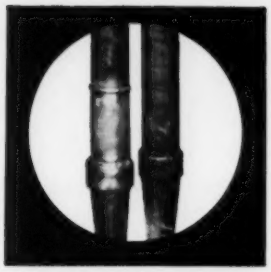
Two Stage Annealing of Type 414 Stainless Steel

Most martensitic chromium steels have very good hot working properties but air cooling from forging temperatures results in a fully hardened, non-machinable structure susceptible to cracking. Annealing is therefore a very necessary production operation. Type 414, developed for greater corrosion resistance than the basic type 410, contains 1.25 to 2.50% nickel which stabilizes the austenite and lowers the critical range. The usual softening treatment is to heat the steel to 1200-1300°F. to obtain soft tempered martensite. Resulting hardness is generally above 240 Brinell.

At the McWilliams Forging Company a method was developed which results in hardness values of 217 to 229 Brinell plus optimum machinability. Forged disks are heated to 1400°F. and soaked to remove all forging strains. A two-stage process is then carried out — first, the charge is dropped to 1300°F. and held for 14 hours. Secondly, the charge is held at 1240°F. for 16 hours, then

(Continued on page 31)

A veteran of 15,000 hours at 1,650°F reconditioned for only $22.50!



ADDING NEW LIFE. When one of the first Inconel radiant tubes ever installed developed a break in the hot leg after four years' use, it was quickly and inexpensively repaired by welding in a new 8-inch section. Note the perfection of the completed weld.

This Inconel® radiant tube is an old timer.

But it isn't on its last legs yet—not by a long sight.

At the ELECTRIC AUTO-LITE plant in Toledo, Ohio, the tube racked up 15,000 hours of exceptionally good service. Exceptionally good, we say, because it operated in a pit-type furnace used to batch anneal small parts at 1,650° F. Few tubes last this long, as you've probably found from your own experience.

After four years, a break finally developed—in the firing leg near the welded joint at the burner casting. The rest of the tube was in excellent shape, so Auto-Lite engineers decided on a salvage job.

Toledo's INDUSTRIAL FABRICATING COMPANY re-bored the old burner casting and inserted a new 8-inch section of 3½" OD Inconel tubing with a wall thickness of .109". Using an inert gas shielded arc welding process and "62" Inconel Filler Wire, they joined the new section to the original casting. Then they butt-welded this assembly to the old Inconel tube.

All it cost was $22.50—and Auto-Lite has a reconditioned Inconel radiant tube that's ready for many more hours of service.

Reports of salvage operations on Inconel wrought furnace and heat-treating equipment are not unusual, for Inconel is one of the most durable high-temperature metals available. Highly resistant to corrosion, embrittlement and destructive oxidation, Inconel serves dependably at temperatures up to 2,200° F. Inconel welds are as heat-resisting and as corrosion-resisting as the alloy itself.

You'll find a great many additional facts about this important alloy in the bulletin, ***Inconel, Workhorse for High Temperatures.*** Your copy is ready and waiting. Write for it now. And consult your distributor of Inco Nickel Alloys for the latest information on availability from warehouse and mill. Remember, too—it always helps to anticipate your requirements somewhat in advance. The International Nickel Company, Inc., 67 Wall St., New York 5. N.Y.

Inco Nickel Alloys

Inconel

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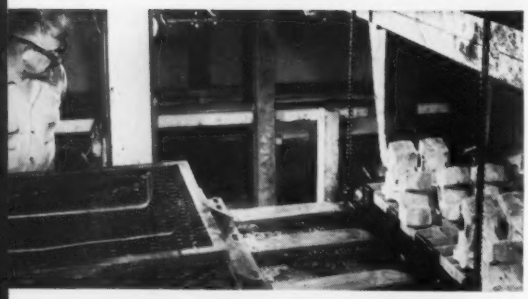
...for Long Life at High Temperatures

Picture shows how oil that forms sludge can clog cooler. Sun Quenching Oil's natural detergency helps prevent such sludge formation.

Oil Coolers Don't Clog with



A New England firm uses five 2400-3000 gallon systems to quench all types and sizes of aircraft and automotive forgings. Since Sun oil was adopted 7 years ago, not one system has required cleaning except for normal removal of mill scale.

Sun Quenching Oils keep oil coolers clean. Teardowns are fewer and maintenance costs less. This is because Sun oils have a natural detergent action that prevents the formation of sludge and aids in removing any deposits that exist.

Can Handle 95% of All Quenching Jobs

Tests show that Sun Quenching Oils give better all-around results. For one thing, they assure hardnesses far above the commonly accepted minimum requirements. In any system that provides normal agitation, they can handle 95 per cent of all quenching jobs.

furnace cooled to 1050°F. followed by rapid air cooling. A similar cycle has also proved effective for annealing type 431 S.S.

(Abstracted from "Annealing Type 414 Stainless Steel Forgings," by A. A. Scafati, *Materials and Methods*, July, 1953.)

Brazing Titanium

Methods have been developed for brazing commercially pure titanium with an oxyacetylene torch, by electric resistance heating and in a furnace using an inert gas atmosphere of commercial purity. Torch heated single lap joints were made which had a high shear strength when tested in tension. Joints brazed with fine silver broke with a ductile shear fracture whereas joints made with other braze metals broke with a brittle shear fracture. Resistance heated lap joints were made with sufficient strength to break the titanium in tension outside the lap area.

The surface films which form on heating, were studied by reflected electron-diffraction techniques. Fluxes were developed for removing these surface films; they incorporated metal depositing reagents such as AgCl, Cu_2Cl_2 and $MnCl_2$. When fused on a titanium surface, these fluxes react with the titanium, undercut the oxide surface, deposit a protecting metal film in a chemical replacement type of reaction.

An approximate titanium-silver phase diagram was constructed; it provided a metallurgical understanding of metallographic structure of joints brazed with fine silver and verified the existence and ductility of the intermetallic compound TiAg, which was discovered in the course of this investigation.

An exploratory investigation for welding commercially pure titanium and a 7% manganese-titanium base alloy by recrystallization welding produced joints with shear strengths equivalent to the shear strength of the annealed titanium base metal.

(Abstracted from a paper presented by N. A. DeCecco, Armour Research Foundation, at the 1953 National Spring Meeting of the American Welding Society.)

(Continued on page 33)

Sun Quenching Oil

Sun Quenching Oils Reduce Operating Costs

Sun oils thin out when heated, drain off parts faster and more completely. Dragout is reduced to a minimum. They do not thicken up, and under normal operating conditions need never be replaced. For more information about Sun Quenching Oils, call your nearest Sun office or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. MR-7.

INDUSTRIAL PRODUCTS DEPARTMENT
SUN OIL COMPANY

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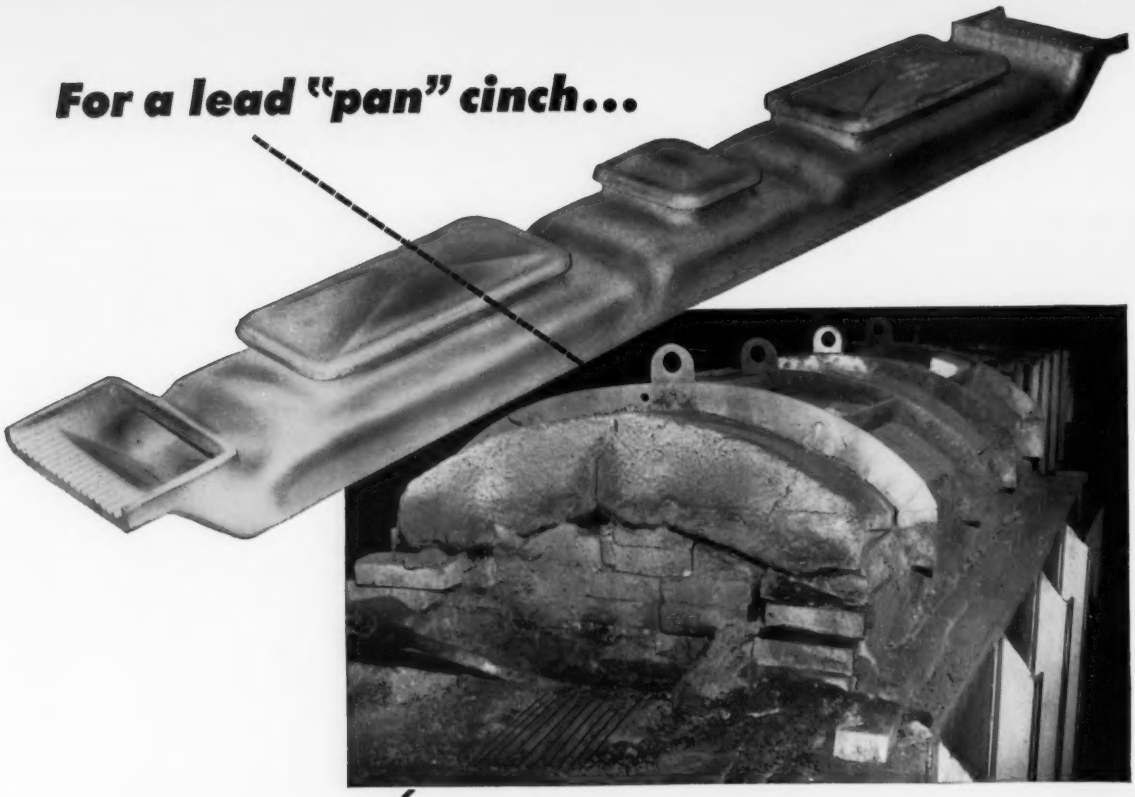
PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

For a lead "pan" cinch...



it's THERMALLOY* to outlast cast iron by 479 days!

A large steel and wire company uses a double-lead patenting furnace to give good drawing qualities to wire. In this process, wire is drawn through a "lead" pan enclosed in the furnace where temperatures range from 1600 to 1650°F.

Previously, cast iron "lead" pans were used . . . and the furnace had to shut down nearly every 21 days because the pan burned out and needed replacement. Then, a Thermalloy "lead" pan with integrally cast sinkers was installed. *To date, this pan has over 500 days of service* . . . saving this company expensive hours of repair and down time.

This is just one example of how a Thermalloy heat-resistant casting has helped a manufacturer to realize more economy in heat-treating parts. Do you have a similar need for Thermalloy in retorts, furnace parts, trays, racks, pots or muffles? Call in an Electro-Alloys engineer for full information, or write Electro-Alloys Division, 4003 Taylor Street, Elyria, Ohio.

THERMALLOY "LEAD" PAN ADVANTAGES

- Resists air-line attack, scaling and oxidation.
- Higher strength prevents sagging and distortion.
- Less weight means easier installation and less maintenance of supporting arches.
- Greater resistance to abrasion.

*Reg. U. S. Pat. Off.

AMERICAN Brake Shoe COMPANY

ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO

Pressure Nitriding

A new method for nitriding under pressure has been developed by members of the Research Department, Oilwell Supply Division, U. S. Steel Corp. The method is said to consume only 5% of the normal amount of ammonia used in nitriding. It was devised primarily for hardening the inside surface of oilwell pump barrels which are about 1½" I.D., 4' to 30' long and have a ⅛" wall thickness. However, the method is adaptable to almost any work.

For nitriding tubes, a capsule of ammonia with a soft solder plug is placed inside the tube and both ends of the tube sealed. As the tube heats up, the solder melts, releasing ammonia within the tube; pressure then increases with temperature. The capsule used for ammonia is SAE 1020 steel pipe filled at about −50°F.

For parts which cannot be self sealed, a pressure tight vessel is used and can be connected directly to an ammonia reservoir by piping with appropriate valves and gauges. Pressure used in this method varies from 200 to 800 psi which can be obtained by heating the ammonia reservoir with hot water; 190°F will give a vapor pressure of 709 psi. The best method found for filling the nitriding vessel has been to heat the vessel until slightly warmer than the reservoir, then open the valves to the vessel, heat to 1000°F and close the valves.

Tests on two nitriding steels, Type 135 and Type N have shown that the temperature required is about the same used in conventional methods — below 1000°F the rate of penetration is too slow for commercial use. Pressures above 800 psi were found to be unnecessary. Case depth increases fairly rapidly for nitriding times up to 45 hours. Maximum hardnesses for both types of steel were reached after 15 hours although the Type 135 softened slightly thereafter.

(Abstracted from "Pressure Nitriding for Hardening Internal or External Surfaces," by R. L. Chenault and G. E. Mohnkern, Metal Progress, April 1953.)

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YOU CAN DO MORE with METAL

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The importance of Heat Treatment in the Manufacture of Oil Well Sucker Rods (cont.)

latitude in co-ordinating heat and time cycles. The necessity for this freedom of adjustment is readily understood when we consider that $\frac{5}{8}$" rods 25 feet long, for example, require about 15 minutes preheat time and 15 minutes at the full normalizing temperature of about 1625 degrees; $\frac{3}{4}$" rods go through on about a 36 minute cycle, and $\frac{7}{8}$" at about 45 minutes.

The time cycle for the drawing operation is approximately as stated for normalizing, but temperature varies from 800°F. to 1200°F., depending upon the physical requirements to be met.

A majority of the full length rod normalizing furnaces are gas-fired, probably due to the fact that gas fuel, whether natural or manufactured, lends itself more readily to many latitudes of control, and can be easily regulated both as to pressure and mixture where such flexibility is advantageous.

The theory behind the heat treatment of sucker rods deviates from the commonly accepted pattern in but one respect, and that is in the lack of importance given to the retention of carbon in the 'case.' Whereas a substantial carbon content is a sought-after quality in most heat treatment techniques, it is not considered so vital to a sucker rod, primarily because it has been established that high carbon content in steel, like concentrated stress areas mentioned previously, tends to accelerate the rate of corrosion.

All major sucker rod manufacturers adhere to the American Petroleum Institute standards as far as critical dimensions are concerned, but in most instances, with the help of industry's most modern heat treating equipment and techniques, they go much further to give the Oil Industry a worthwhile product; one designed to do a rugged job under severe conditions, and with a minimum investment. ■■■

It was a young bookkeeper in a bank, whose health broke down because he worked long hours over his figures, who invented and built the first commercially successful adding machine. Name, William Seward Burroughs.

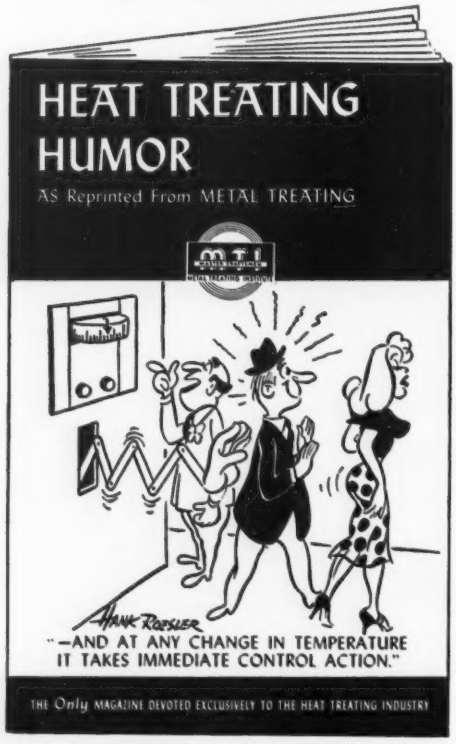
Every improvement which has contributed to our ease, comfort and convenience had its origin in our country's industrial development.

Growing pains come when a kid goes to the movies and has to pay adult prices for the first time.

—Bernie Wayne.

The trouble with some guys is that they have glowing personalities only when they're lit up.—*Jim Dilley.*

NEW EIGHTEEN PAGE CARTOON BOOKLET "HEAT TREATING HUMOR"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AS Reprinted From METAL TREATING
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THE Only MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

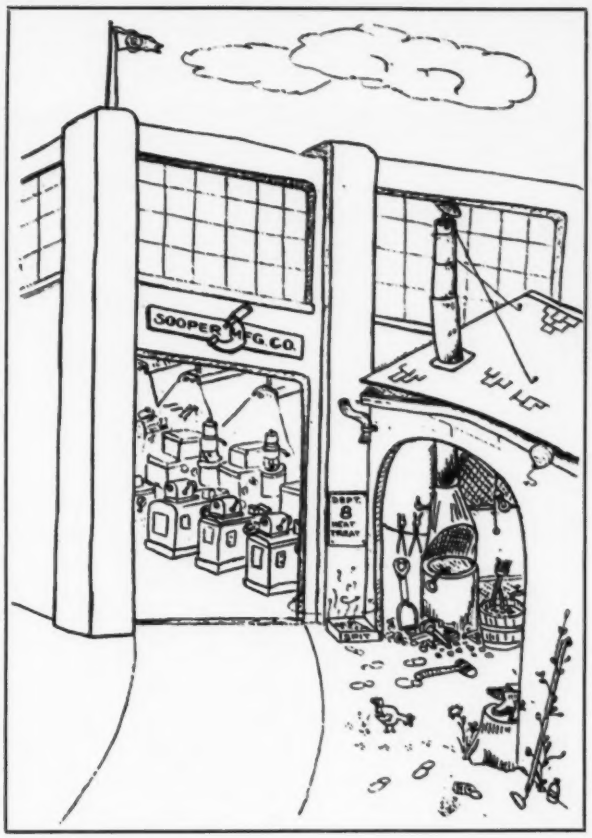
For prices in quantity lots, imprinted, write to Editor, Metal Treating.

LETTERS TO THE EDITOR

Dear Editor:

Enclosed you will find a clipping taken from the March-April issue of your magazine.

During the last war, I had a discussion about the same subject and the conversation led to heat treat equipment some plants are known to have. After two or three days, the engineer I had spoken to came down to the heat treating room and handed me enclosed drawing that he had drawn up. I got a great kick out of studying the small details he added to the sketch and thought perhaps you or your readers would enjoy looking at it.



I hope to remain on your mailing list.

CLIFFORD BOUDREAU
Heat Treat Dept.
The Fuller Brush Co.
Hartford, Conn.

Dear Editor:

As a senior student of Metallurgical Engineering at the University of Minnesota, I am very interested in obtaining your publication "Metal Treating".

Would you please advise where and how I might subscribe to this magazine?

JOHN M. FAULKNER
27 West 14th Street
Minneapolis, Minnesota

Dear Editor:

Please send information on how the writer could get two (2) copies of your January-February 1953 issue which includes an article on the heat treatment of Ductile Cast Iron.

The writer would also be very much interested in learning how he could get on your regular mailing list.

J. HARRY REED
Manager of Sales
The Youngstown Foundry & Machine Co.
Youngstown, Ohio

Dear Editor:

Our gang got some laughs from this purchase order. Perhaps yours will also.

L. A. LINDBERG
Lindberg Steel Treating Company

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Lindberg Heattreating Co.
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Chicago Ill.

1 die of Ketos to be hardened & tempered to 59-60 R

Why not charge more for hardening & less for straightening when the works is all bend up enyhow

turn the piece over a plenty while heating up & find the thing perfect in the first place.

Dear Editor:

Read your interesting Editorial in the January-February issue of METAL TREATING, covering the Classification of Tool Steels. The Society of Automotive Engineers apparently has finished its work on standardization of Tool Steels. Can you tell me where a copy of this may be obtained?

Also noted that the Joint Industry Conferences are standardizing Tool Steels. Have they completed their work? If so, are copies of their data available?

Enjoy your excellent magazine very much. Thank you for any information you can give me on the above.

L. G. MILLER, Chf. Met.
Greenlee Bros. & Co.
Rockford, Ill.

Two Salem Gas Annealing Furnaces—Model 501

1 H.P. Induction Motor drives metal conveyor 21" wide with electric control panels. Each unit occupies a space 7½ ft. wide x 26 ft. long. Capacity—3,475,000 BTU or 3,000 cu. ft. per hr. Each unit is connected to conveyor 13½" wide x 10 ft. long. Excellent condition. Priced to sell.

Contact: W. Furlong, Gibson Mfg. Corp., Longmont, Colorado.

Manufacturers' Literature . . .

The literature listed below contains information of interest to heat treating organizations. For your copy write direct to the manufacturer and be sure you mention seeing it reviewed in "Metal Treating."

HOT OIL QUENCHING

A four-page folder is available from E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa., which describes the properties and application of Mar-Temp oil for hot quenching. Included are data on oxidation, viscosity and quenching speed as well as several case histories illustrating the possibilities for distortion control with hot oil quenching.

NON-INDICATING CONTROLLERS

The Burling Instrument Company of South Orange, New Jersey, has issued Bulletin 101, the first of a new series describing their line of temperature controls operating on the principle of differential expansion of solids.

This bulletin covers the Models H-1S and V-1S which are primarily used for high temperature safety alarms and cut-outs up to 1800°F. Included are complete descriptions of operation, dimensions, methods of mounting, and operating specifications.

INDICATING CONTROLLERS

A new bulletin, F-5783, describing the complete line of Model 200 Series Capacitrols is now available from Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill. Of interest is the new Model 221C which has the added Capaciline for "straight line" temperature control. A complete description of the anticipating control action of the Capaciline has been made a part of this new bulletin.

Additional descriptive information is also included concerning other Model 200 Series Capacitrols that are used for on-off and proportioning control.

WELDING AND METALLURGICAL ASPECTS OF STAINLESS STEELS

A new bulletin on the welding and metallurgical aspects of stainless steels has been announced as available from the General Electric Company, Schenectady 5, N. Y.

The 8-page publication, designated GET-1955, serves as a practical guide to better practices and results when arc welding stainless steels. It covers the three classifications of stainless steels: martensitic, ferritic, and austenitic.

The fully-illustrated booklet was authored by W. G. Blackwell of the G-E Welding Department.

OIL AND AIR HARDENING TOOL STEELS

A new 28-page booklet has been prepared by the Bethlehem Steel Company, Bethlehem, Pa., covering the principal characteristics of six widely used oil and air hardening tool steels. Separate sections on each type give detailed instructions for proper application, working and heat treatment. Included are data on procedure and results of hardening, martempering, tempering and annealing. The booklet is well illustrated with various applications of each type of steel.

PROPORTIONING MIXERS

A new 12-page Catalog No. 805A, available from Hauck Manufacturing Co., 124 10th St., Brooklyn 15, N. Y., describes the simultaneous controlling and accurate proportioning of air and gas with a single control valve for manual or automatic operation. A consistent air-gas ratio is maintained over the entire range of the mixer capacity.

Mixer capacity tables are given for 5 different kinds of gases and for 8 air pressure ratings.

HIGH VACUUM PUMPS

A new, extensively revised edition of the 36-page catalog, "Stokes Microvac Pumps for High Vacuum," has just been issued by F. J. Stokes Machine Company, 5500 Tabor Rd., Philadelphia, Pa. The new catalog, No. 750, includes valuable tables of formulas, constants, and conversions frequently used in vacuum processing; solutions to problems of pump selection for typical vacuum systems; and useful information on continuous oil purification and other maintenance procedures for high vacuum pumps.

LABORATORY EQUIPMENT

A new edition of "What's New for the Laboratory," 18th in the series, has just been announced by the Scientific Glass Apparatus Co. Inc., Bloomfield, N. J.

Many new items are featured in this 16-page brochure. Included are: a new line of low-priced industrial balances, a number of polyethylene aids (miniature funnel, stirring rod, scraper spatula, pipet jars, carboys, etc.), a utility water bath, duplex heater, penetrometer, wet test meter, laboratory glassware washer, plus many others.

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"It's easy to change from one specified case depth to another with AEROCARB® E & W liquid carburizing salt baths"... says Commercial Controls Corporation, Rochester, N. Y.

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For example, the locking bail made of C 1010 steel with pins of B 1113 steel is carburized in AEROCARB E & W salt baths at 1400°F for five minutes and oil quenched. Maximum case of .001 inch is specified to give desired stiffening to this part.

The other extreme is the feed ratchet, also of B 1113 steel, carburized in AEROCARB E & W at 1650°F for 60 minutes to give a case depth of .015 - .020 inches. Ratchets, which must have good impact strength, are then air-cooled, and teeth are induction hardened to 72 Rockwell 45N minimum, leaving hubs soft at about 90 Rockwell B.

Commercial Controls Corporation finds water-soluble AEROCARB E & W economical to use and easy to remove from parts. Results are consistent from lot to lot of treated parts with distortion controlled to a minimum. Get the full details on AEROCARB E & W salt baths. They may help you with your heat treating problems.

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INDUSTRIAL CHEMICALS DIVISION
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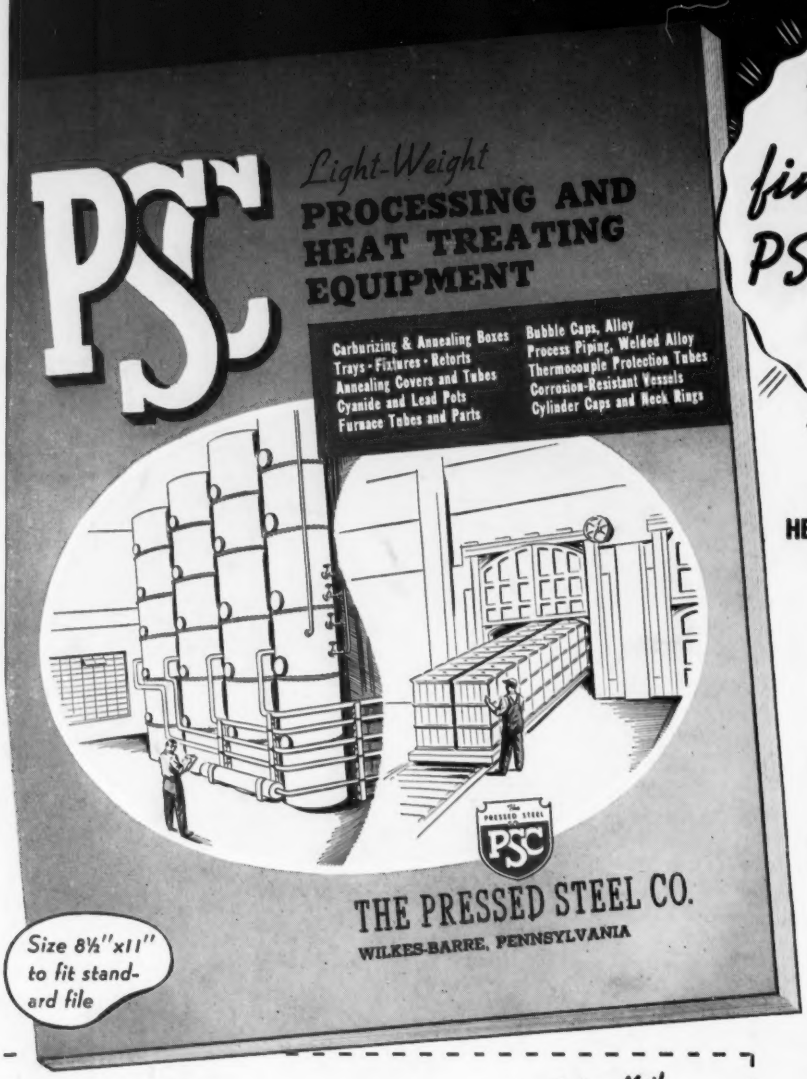

You will find the new PSC CATALOG helpful

CLASSIFICATIONS OF PSC HEAT AND CORROSION-RESISTANT INDUSTRIAL EQUIPMENT

Baskets, annealing & carburizing
Baskets, cyanide dipping
Baskets, pickling
Bends, alloy pipe & tubing (welding)
Boxes, annealing & carburizing
Caps, bubble (fractionating tower & still)
Caps, cylinder (compressed gas)
Covers, annealing (Bell furnace)
Covers, annealing (elevator furnace)
Fixtures, carburizing
Flights, conveyor (syn. rubber plant)
Headers, air pre-heating
Manifolds, gas exhaust
Muffles, carburizing
Piping, process (alloy only)
Pots, carburizing & annealing
Pots: lead, cyanide & salt
Racks, annealing & carburizing
Racks, sheet pickling
Retorts, carburizing
Rings, neck (compressed gas cylinder)
Tanks, copper annealing
Tanks, pickling
Trays, annealing & brazing
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